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Severn Tide

Possible Effects of Altered Circumstances

IT is now just eleven years since the Severn Barrage Committee reported in favour of exploiting the exceptional tidial conditions of that river for the generation of electricity. There the matter rested, so far as was generally known, until the appointment by the Minister of Fuel and Power at the end of last year of a small expert body to review the conclusions of the Report. No doubt the cause of the revival of interest in a scheme which was estimated to produce electricity at an overall cost only two-thirds of that which would be incurred by steam and to save about a million tons of coal per annum, is due largely to the enforced growth of "fuel-consciousness."

The delay in considering the furtherance of the proposals was due to a variety of reasons. Some £12 million of the £50 million estimated as the total cost of the whole project was allocated to the provision of railways, roads and harbour facilities. Whether these were worth the price it was outside the province of the Committee to inquire, but to debit this expenditure against the electrical part of the scheme would have put it out of court on economic grounds.

Provision for Contingencies

There may have been cause to doubt whether the 12½ per cent. on capital expenditure allowed for contingencies would have been enough to provide for all the unforeseen difficulties to be expected in carrying out the first scheme of its kind of any magnitude in the world. Mr. R. K. Abell stated in a paper presented earlier this year before the Junior Institution of Engineers that its tidal range was exceeded only by the 10 ft. of Fundy Bay in any comparable scheme investigated.

Since the cost of electricity from the dam would be governed almost entirely by capital charges, which would be swollen by the capitalisation of interest during construction, any lowering of the rate of interest or reduction in the period of fifteen years allowed, which Mr. G. A. Maunsell suggests in his article this week is quite feasible, would clearly improve the prospects of success, especially if considered in relation to increased coal prices.

Barrage and Storage

The Brabazon Committee did not advocate the production of electricity from a barrage station, as such. Indeed it held that a barrage station could not compete economically with coal. What it did recommend was a barrage station plus a storage station, since without the latter there could be no reduction in the number of coal-fired stations required in consequence of fluctuations of tidal power. Nevertheless, it has irked many engineers that about 60 per cent. of the primary barrage energy should be used for pumping water into a reservoir, involving, moreover, an expenditure of £11 million.

It has been shown that peak tidal power is little more than the minimum night load of the grid, though this raises new questions of transmission-line regulation; it has also been suggested that advantage might be

taken of high tides to shut down steam plant for maintenance. There is also the possibility, alluded to by Sir William Halcrow in his Cantor Lecture (reported in this issue), that storage might take the form of heating water for distribution in towns. It will presumably be the task of the newly appointed reviewing committee to decide whether conditions have altered to such an extent since the original Report as to justify revision on a point that was formerly regarded as fundamental.

G.W.R. Objection

PART of the Severn Barrage plan consists of the construction of a new road crossing over the estuary which would provide a much shorter route than road traffic has to take at present. This would result in intense competition with the Great Western Railway which at present enjoys an advantage in its Severn Tunnel. Sir Edward Cadogan mentioned this matter at the annual meeting of the G.W.R. last week. He envisaged a great reduction in the company's revenue as a result but did not suggest any remedy. Is it possible that compensation for this loss may have to be included in the cost of the scheme?

Ninety Per Cent.

THE reconstructed Joint Committee of Electricity Supply Organisations claims to represent 90 per cent. of the industry, a claim which was repeated in Mr. Townley's letter in our last issue. It has been asked how this 90 per cent. is calculated. If it is merely on the number of undertakings represented, as has been suggested, the Committee may not be truly representative. In 1937-38 358 undertakings out of the total of 598 sold less than 10 million kWh each, while 98 large undertakings were responsible for 77 per cent. of the total sales; these should not be considered on the same footing. Even so it is possible that 90 per cent. might be a fair "cross-section" of the industry and thus representative in "weight" as well as in number.

Capital Comparisons

IT is not easy to find a basis for comparison; output and sales are complicated for a number of undertakings; capital expenditure is probably as safe a criterion as any. On this basis the members of the constituent associations of the Joint Committee, together with those power companies which remain with it, may be regarded as having had a capital expenditure of £498·15 million at the end of 1937-38. The corresponding figure for the thirteen power companies dissociated from the Committee was £52·35 million, *i.e.*, about 9·5 per cent. of the total, which leaves only 0·5 per cent. for the remaining unrepresented undertakings. It is probable that for all practical purposes this is not far out, in which case the Joint Committee's claim can be sustained.

The Power Companies

WHAT proportion of the whole membership of the Power Companies' Association is represented by the eleven companies who have adhered to the Joint Committee? In number they are 46 per cent. of the total. Their capital expenditure at the end of 1937-38 was £74·4 million against £52·3 million for the "non-Committee" companies; the energy sold by them in 1937-38 was 4,327 million kWh, against 2,752 million kWh. Thus on these two bases the "Committee" companies were responsible for about 60 per cent. of the total—a fair majority.

A Many-Sided Profession

IN a few speeches, all brief and to the point, which followed the luncheon given by the Association of Supervising Electrical Engineers last Saturday, the large number of subjects touched upon will illustrate the extraordinary variety of the electrical profession and the number of topics now under consideration by those who serve in it. Aspects receiving most prominence included installation, maintenance, water power (including tidal), telephony, agriculture, research and, finally, the quality of personnel both in research and in its practical application. Of all these chief place should surely be accorded to the last two, since upon them all the rest depend.

Educational Schemes

AFTER the war we must endeavour to increase our export trade and we can only succeed in this by offering equipment and appliances of outstanding merit. Such goods can only be produced by skilled and intelligent craftsmen directed by engineers with fertile, creative minds. This necessitates much greater attention to training than has hitherto been general. There are already

several excellent individual schemes in operation which provide examples of what is required and some of these are to be described in a series of articles which is started by Dr. A. P. M. Fleming in this issue. At the same time the authors, who are largely responsible for these schemes, express their views on the general subject.

Electric Traction

FURTHER electrification of the Southern Railway system is being closely examined, according to the chairman (Col. E. Gore-Brown) speaking at the company's annual meeting last week. Already 720 route miles of the Southern have been equipped for electric traction and electrical operation represents 60 per cent. of the total passenger train-miles operated. Col. Gore-Brown pointed out that the benefits in increased traffic brought about by electrification tapered off as the distance from large towns increased and the matter became one of economy in operation. The considerable increase in the price of coal and the great amount of deferred maintenance of steam stock which war conditions have engendered are two factors which should influence the study of electrification in a favourable manner.

S.R. Goods Traffic

TECHNICAL difficulties have in the past prevented the extension of electric traction to all traffic on the Southern Railway's electrified lines, and it has been necessary to retain steam locomotives for certain purposes, particularly the haulage of freight trains. The announcement last year that the company had developed a new electric locomotive to operate on the third-rail, low-voltage system therefore opened up important possibilities. Col. E. Gore-Brown was able to inform the stockholders that the first of these locomotives which was put into regular freight service last June had proved very efficient and up to the end of the year had run 40,000 miles.

War Additions

THE complexity of the wages structure in the engineering industry makes a proper appreciation of the position very difficult. It is stated in the February *Ministry of Labour Gazette* that average wages of adult male workers in the metal, engineering and shipbuilding trades had risen by 84 per cent. between October, 1938, and July, 1943. This, however, included all overtime, nightwork, piecework, etc., which have increased very considerably during the war ; the average hourly rate rose by 64 per cent. Moreover, conditions in 1938 with regard to unemployment and short-time were different. Against this rise the official cost-of-living index has shown an increase of about 30 per cent. Making due allowance for the doubtful value of the official index and for the extra payment for extra effort, it seems as though rates of pay have at least kept pace with the cost of living.

Scrapping v. Repair

IN view of the great amount of installation work that housing will entail after the war, the development of simple and inexpensive equipment is essential. This, Mr. Hamlyn Drake suggested in presenting his I.E.E. Installations Section paper last week, might be of the "Ford" type, designed for easy replacement rather than easy maintenance of faulty components. The only alternative was, he considered, the "Rolls-Royce" type that was intended to last. The context made it clear that standardisation and absence of "frills" were relied on to reduce prices and not any lowering of the general character of installation work. Indeed, there is too small a margin between a minimum quality required to secure safety from fire and shock and a full compliance with the I.E.E. Regulations to permit of any worth-while reduction in costs in that way.

Inter-changeability

STANDARDISATION may sacrifice future advantages to present gains unless its purpose is kept clearly in mind. Mr. Drake's object was to facilitate replacement of accessories by others of perhaps different manufacture (largely by standardising fixing dimensions) and thus remove a frequent cause of annoyance to users. This interchangeability will be especially necessary if as much work as possible on components is done in the factory rather than in the often difficult conditions prevailing on the site. The author's aim was certainly not to restrict developments in design—the last thing to be desired. The discussion on the paper showed that all-insulated systems receive strong support and should be taken into account in any plans for the future.

Engineers of the Future—I

Education and Training

Maintaining the Supremacy of British Craftsmanship

By A. P. M. Fleming,
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In this article, the first of a series by leading authorities on the subject, Dr. Fleming specifies the nature of training which young engineers need to equip them for the new conditions and describes steps which have been taken to provide it

IN this country it has been traditional that an essential part of an engineer's education shall be practical training in the works. Originally a survival from the apprentice system of the Middle Ages, the character and purpose of this practical training have changed greatly in the last fifty years. In the past, young men entered works and were immediately and solely engaged in manual operations. Those who possessed ability and initiative advanced through acquiring by themselves such technical knowledge as was then available. With the modern increase in knowledge and specialisation, this haphazard method is no longer good enough, and works training must now be designed to deal with two types—manual and non-manual workers. Even for manual workers the position has changed greatly in recent years. In the past many young men settled down to become first-class craftsmen, and the attractions to other types of job were less than they are today. Nowadays, mass production methods tend to put the stress of craftsmanship on the toolmaker and the maker of the machines of production, and the raising of the school-leaving age and continued education to 18 alters the outlook of young men who might otherwise have become craftsmen. These conditions are detrimental to the recruitment of young men for craftsmen and the time is approaching when the craftsman's position will have to be established on a different basis.

Apprentice fitters in the turbine assembly shop

Further, much closer discernment will be necessary to determine the type of boy who is likely to make a good craftsman, and then the greatest economy in time will be necessary for giving him effective training.

The non-manual personnel in the electrical industry, which comprises such people as inspectors, testers, draughtsmen, servicing staff, erectors, designers, research workers, managers, etc., requires a character of training suited to the character of employment and the educational attainment of the individual. Where this is, say, a good secondary school level with possibly a Higher School Certificate, but without the possibility of a university education, then the practical training of such a youth will not be designed to make him a craftsman, but to familiarise him thoroughly with the various aspects of works organisation, processes of manufacture, their degree of commercial accuracy and precision, the handling of the finished plant in the testing departments, and experience in the handling of men. If, however, during this period, which may be of about four years' duration, the youth does not acquire by part-time methods a workable technical knowledge, then his degree of usefulness as a non-manual worker and his possibilities of promotion are relatively small. On the other hand if he is mentally capable of making full use of his opportunities, he is

able to rise to the highest technical positions.

The young man who is more fortunate in having been able to go to a university goes into the works for usually two years, but here his practical training is intended partly to enable him to find an outlet suited to his inherent capabilities and desires, and partly to give him a background of methods, processes, and works organisation. Its value will be quite different according to whether he becomes, for example, a designer, a commercial engineer, a production supervisor, or a research worker.

The Metropolitan-Vickers Electrical Company has been a pioneer in the field of education and training for apprentices ; and it may be useful to give here a brief summary of the schemes which have been developed. Trade apprentices attend a Works School for a few of the working hours each week. This school is not intended to supplant the admirable local facilities for part-time evening technical instruction, whereby a proportion of those who enter the industry, with relatively few educational advantages, as artisan apprentices can acquire such technical knowledge as will enable them to advance to staff positions. Rather is it intended to provide the right kind of general education and trade instruction for those youths who will remain craftsmen. The company's conception of training does, however, go far beyond the mere provision of vocational instruction. It aims at the development of young citizens, and in this connection the trade apprentices were first encouraged to form an Apprentice Association, appointing their own council and governing their own affairs. A spirit of independence and self-reliance was thus engendered, and at a relatively early stage the Association became financially independent of help from the company. This organisation is now the natural means of contact with the management in all matters affecting apprentices' interests.

The Association forms a most effective means of detecting and fostering the apprentices' capacity for leadership and initiative, and in this way young men can be marked for promotion to positions which will still further develop and utilise their capacities. Some 25 per cent. of the boys who enter the company as artisan apprentices rise to staff positions, and through all the facilities available can compete with those young men who have had the advantage of a university education. . Throughout the company's organisation at home and abroad there are to-day many men in prominent positions who have started as trade apprentices.

Schemes of practical training have also been developed for university graduates and youths of county high school, grammar school and public school education. These men form an integral part of the Apprentice Association. During training university graduates are paid sufficient to maintain them independent of any outside support, and the young men who enter immediately on leaving public school, etc., receive a wage which provides a large part of their necessary maintenance, even if living away from home. The scheme provides practical experience in the various phases of manufacture, testing, drawing office, design, commercial departments and research laboratories.

Apprentices on switchboard assembly

Of late years a pre-university course has also been available for boys from secondary and public schools. This short period of industrial experience has proved of great value in providing a practical foundation on which to build the theoretical structure of the university course, and in enabling undergraduates to take a larger and more intelligent part in their university life because of their more mature outlook and general experience of life.

Such organised schemes of training should be general throughout the industry. Certain of the details can only be applied by the large concerns, but the whole engineering industry should, and in the future must, provide first-class, organised training as a prelude to specialised staff employment, if we are to

still be a premier manufacturing country.

The training of an engineer—especially in these days of rapid research and development—can never be complete, and importance is therefore to be placed on the provision of advanced instruction by experts for all members of the staff. This type of education has up to now been rather neglected throughout the engineering industry in this country. In a large concern the courses can often be given by members of all branches of the staff. For example the research staff might cover such selected subjects as "High Vacuum Technique" and "The Use of the Cathode-Ray Oscillograph." Co-operation with the universities would be useful in this type of instruction; and it is indeed to be hoped that future developments will lead to some continual interchange of academic and industrial staffs.

Another desirability for the future is that manual training be done in a separate works training school. Some of the *intensive*, practical courses given in the Services have recently shown how much can be accomplished so quickly by this sort of arrangement. It is not intended that all the manual training would be done in the school, but a substantial part of it. The work would be of such a type, and would be done at such a speed, as to lay the emphasis on training rather than production, a condition which cannot obtain in the main works.

In conclusion, the importance of education and training, combined with research, to the future of the engineering industry, and indeed to the future of the country as a whole, cannot be too strongly stressed. If this country is to maintain its standard of living, and its share of the world markets, the excellence of its manufactured products must be second to none. And to maintain this position, amidst the keen competition and rapid new developments of to-day, it is vital that we should have first-class education, technical training, manufacturing experience and research.

Wages and Working Hours

Present and Pre-War Figures Compared

DETAILS of average earnings and working hours in the principal industries of the country as at July last are given in the February *Ministry of Labour Gazette*. About 54,500 establishments employing a total of six million workpeople are covered and it is shown that the average earnings in the first pay week of July were 121s. 4d. for men, 47s. 4d. for youths and boys (under 21), 62s. 11d. for women (excluding part-time workers) and 33s. 11d. for girls under 18. The average for all workers was 93s. 7d.

It is shown that the average percentage increases in wages since October, 1938, were as follows: Men 76; youths and boys 81; women 91; girls 83; all workers 76. The greater increase in women's wages is attributed to the fact that many more are doing work formerly undertaken by men.

The average hours worked per week have risen as follows:—Men from 47·7 to 52·9; youths and boys from 46·2 to 48; women from 43·5 to 45·9; girls from 44·6 to 45·1; all workers from 46·5 to 50·0.

Detailed figures indicate that in the electrical engineering industry average wages were as follows; the increases as compared with October, 1938, are given in parentheses:—Men 131s. 7d. (77 per cent.); youths and boys 44s. 10d. (81 per cent.); women 64s. 8d. (99 per cent.); girls 35s. 7d. (84 per cent.); all workers 92s. 6d. (82 per cent.). The average weekly hours of work in July, 1943, were as follows:—Men 54·5 (10·5 per cent. increase); youths and boys 49·0 (7·5 per cent.); women 46·7 (4·2 per cent.); girls 46·0 (1·8 per cent.); all workers 50·7 (6·7 per cent.). Average hourly earnings in July, 1943, were: Men 29·0d. (60 per cent. increase); youths and boys 12·0d. (55 per cent.); women 16·4d. (73 per cent.); girls 9·5d. (73 per cent.); all workers 20·5d. (63 per cent.).

For electric, cable, apparatus, lamp, etc., manufacture the following average weekly wages are given: Men 127s. 11d. (75 per cent. increase); youths and boys 48s. 2d. (57 per cent.); women 64s. 2d. (80 per cent.); girls 35s. 10d. (72 per cent.); all workers 84s. 8d. (69 per cent.). Average hours of work per week were as follows: Men 54·4 (8·4 per cent. increase); youths and boys 48·1 (1·5 per cent.); women 47·0 (4·0 per cent.); girls 45·4 (slight decrease); all workers 49·6 (4·0 per cent.). The July, 1943, hourly average rates of wages were: Men 28·2d. (62 per cent. increase); youths and boys 12·0d. (55 per cent.); women 16·4d. (73 per cent.); girls 9·5d. (73 per cent.); all workers 20·5d. (63 per cent.).

Average weekly wages in the electrical contracting industry in July, 1943, were:—Men 126s. 8d. (60 per cent. increase); youths and boys 38s. 10d. (84 per cent.); all workers 94s. 3d. (66 per cent.). Weekly hours of work were:—Men 55·7 (11·6 per cent. increase); youths and boys 50·5 (6·5 per cent.); all workers 53·7 (10·5 per cent.). The average hourly rates of wages were: Men 27·3d. (42 per cent. increase); youths and boys 9·2d. (73 per cent.); all workers 21·1d. (50 per cent.).

Much smaller changes in the electricity supply industry are revealed by the statistics. Average weekly earnings in July, 1943, were:—Men 102s. 5d. (41 per cent. increase); youths and boys 35s. 11d. (37 per cent.); women 65s. 10d.; all workers 95s. 9d. (39 per cent.). Average hours per week were:—Men 50·6 (2·6 per cent. increase); youths and boys 47·2; women 42·2; all workers 49·9 (1·6 per cent. increase). Hourly rates averaged as follows: Men 24·3d. (38 per cent. increase); youths and boys 9·1d. (42 per cent.); women 18·7d.; all workers 23·0d. (37 per cent.). The number of women employed in the industry before the war was negligible.

Severn Tidal Power

Improved Prospects for Economic Utilisation

By G. A. Maunsell, M.Inst.C.E., F.R.S.A.

THE utilisation of tidal power is an enterprise which has attracted engineers for a century past but, beyond the installation of one or two small plants in scattered localities, little has actually been done to carry the idea into practice anywhere in the world.

Perhaps the chief difficulty in the way of using tidal power is that the turbines can as a rule operate only for short periods each of about seven hours duration followed by periods of about five hours inactivity. The periods occur from half-an-hour to an hour later each successive day. The quantity of power available during the running periods also varies from week to week, there being roughly twice as much power available during a week of spring tides, *i.e.*, when the moon is full or there is no moon, than during a week of neap tides, *i.e.*, round about the half-moon stages. Another difficulty which applies to the use of tidal power everywhere is that turbines do not operate economically on low variable water heads and the cost of turbine installation goes up enormously as the operating head diminishes, so that reasonably good results can be attained only in those very rare localities where a freak combination of natural factors creates an abnormally large tidal range. Such localities are the Bay of Fundy in Canada and the Severn Estuary in this country where in the reach between Avonmouth and Chepstow the rise of tide is several times greater than the normal world range.

The author, who was concerned in the preparation of the original (1920) scheme for harnessing the Severn tides, discusses subsequent developments which place the proposals in a more favourable light

Changed Fuel Situation

A factor which has in the past militated against the development of the Severn tidal power has been the existence of an abundance of cheap coal in the South Wales area. Many people may have feared—although probably without good reason—that the installation of a huge hydro-electric development would mean throwing many thousands of coal miners out of work. Full utilisation of the Severn tidal power might indeed have the effect of saving the labour of 4,500 coal miners and the consumption of 1¼ million tons of coal per year. So much has recently been heard, however, about the shortage of labour in the pits, of the perils and hardships of a miner's life and of the reluctance of boys to engage in what they regard as uncongenial work underground, that doubts may now arise in people's minds as to whether it really is a good thing to augment this class of labour and whether it may not be better to develop new sources of crude heat and energy so as to eliminate coal in places where other sources of power are available at about the same overall cost. The need for the conservation of our natural coal reserves points also in the same direction.

These are some of the broad general considerations which concern the question of the Severn power. All of them are subject to change as the years pass and there has, in fact, been a great deal of change in most of these factors during the twenty-four years that have elapsed since the Severn Barrage Scheme, worked out in the Ministry of Transport under the direction of Sir Alexander Gibb in 1920, first brought the utilisation of the Severn power prominently before public attention by presenting a feasible project whereby the power might not only be harnessed but, what is equally important, delivered over for public consumption in the form of a steady controlled output.

The 1920 Scheme

The Ministry of Transport scheme selected as a site for the barrage a place called the English Stones, situated at the farthest downstream point in the estuary where the maximum tidal power could be trapped, this being also a place where the width and configuration of the channel were such as to provide the best kind of rock foundations for the works and also the necessary space in which to set up the long turbine dam for the downflowing water, the long sluice dam for the upflowing water and also the locking arrangements whereby ships could pass through the dam without serious interruption on their way up and down the river. This English Stones site happened also to be the ideal location upon the natural line for building a road and railway bridge to connect England and South Wales. The bridges were to be low-level viaducts passing from side to side without gradients. An uninterrupted rail and road service was to be secured by the ingenious and probably unique device of alternative road and rail tracks crossing the upper and lower ends of the ship

lock by means of twin bascule bridges, one of which could always be in the down position to maintain continuous traffic.

The Ministry of Transport scheme solved the great difficulty of intermittent power output by the proposal to create an artificial lake in a rocky valley known as Trelleck Grange, situated high up above the mouth of the River Wye and distant only about eight miles from the main dam across the Severn at English Stones.

Power-levelling Methods

During periods of power output at the main tidal dam, batteries of motor-driven centrifugal pumps were intended to force water from the River Wye to ascend a tunnel leading into the Trelleck Grange high-level reservoir. Conversely, during the slack periods at the tidal barrage, high-head turbines driven by water descending the same tunnel would generate electricity at the storage-reservoir site, so enabling a more or less constant electric power output from the whole combined outfit to be maintained at all states of the tide.

Such was the scheme of 1920, which may perhaps have helped to earn for the Transport Ministry the soubriquet " grandiose." Then came the post-war slump and the debacle of the scheme and of the Ministry as then constituted (1921).

Four years later, in 1925, Mr. Baldwin's Government appointed the Committee known as the Brabazon Committee to review the matter. They called in independent consulting engineers (Messrs. Coode, Wilson, Mitchell & Vaughan-Lee) to assist them in their investigations which occupied seven years. Early in their examination they appear to have reached the conclusion that the project put forward by the Ministry of Transport in 1920 was the only one which offered prospects for the successful solution of the problem. The engineers accordingly concentrated upon the working out of the details of this scheme and Professor Gibson, himself a member of the Committee, carried out most interesting model experiments to ascertain the probable siltation and other estuarial effects which might be created if the proposed barrage at English Stones were built.

Conclusions of Brabazon Committee

The Brabazon Committee reached the conclusion that the electrical energy generated intermittently by the tidal turbines could not compete economically with that generated at selected coal-fired stations but that, if the proposed high-level reservoir storage system were used in combination with the tidal system, this, while reducing the estimated output of electricity of the whole combined installation from 2,207 million to 1,610 million kWh, would enable the latter quantity to compete economically with coal power. The cost of this water power when converted into electricity and delivered to the grid would, they estimated, be only two-thirds of the cost of electricity generated at equivalent coal-fired stations.

According to this computation the annual saving from the electrical part of the undertaking estimated by them as at least one million pounds per annum is evidently more than sufficient to finance the whole of the auxiliary works, that is to say, the railway bridge, the road bridge, and the deep water impounded basin upstream of the dam with its great possibilities for shipping and industrial development. All these amenities could, so to speak, be thrown in free of charge and carried on the back of the cheap power.

Now that the Brabazon Committee's conclusions are being reviewed by the small expert Committee recently appointed, many questions are likely to come to the fore once more. There is, for example, Lord Brabazon's statement in the House of Lords last year that the time allowed by the Committee for the construction of the works (which was fifteen years) could be materially reduced.

Speed of Construction

This matter of the constructional speed of great public works is a very special one. Modern methods and modern types of design properly combined are capable of achieving remarkable results from the point of view of speed and simplicity. A case in point which has recently come within the writer's experience is the construction of reinforced-concrete floating docks which are at the present moment, and in spite of war duress, being built in less than one-tenth of the time which would have been considered necessary before the war.

The really essential thing here is to combine the design and the methods of execution in one comprehensive plan. Six years should be amply sufficient in which to build the works contemplated in this case, a shortening of the construction period which would have an important effect on the economics of the project because a considerable part of the total expenditure estimated by the Brabazon Committee consists of interest charges at 4 per cent. compound interest.

Of the total of £25 million required in the estimate to build the tidal barrage and power station, no less than £5 million consists of interest paid out during the unremunerative fifteen-year construction period. The rate of interest has an even greater bearing on the whole economy, as not only affecting the interest during construction which is part of the capital outlay but—what is of course more important—affecting the annual interest charge during the life of the undertaking. The 1933 Committee worked on a 4 per cent. basis. Having regard to present interest rates

plus taxation, a rate of 2½ per cent. would now appear more appropriate.

The Committee estimated the total annual cost of producing electricity at the barrage to be £2,451,258 and the total capital outlay on the power works to be £38,426,475. A reduction in the interest rate from 4 to 2½ per cent. would mean a reduction in production cost of over £500,000 annually, that is, it would bring down production costs by about one quarter.

Another way of improving the economics of the project has been opened up by the grid system and if the proposal to superimpose a very high-voltage grid is proceeded with, prospects in this direction will be still further improved.

The point is that when the writer, working under Sir Alexander Gibb in the Ministry of Transport, first devised this scheme in 1920, the grid was not in existence and means whereby the huge electrical output of the barrage could be assimilated by industry were largely lacking. We thought, therefore, that we were bound to provide a storage reservoir of such a size that it would absorb all surplus energy and completely flatten out the curve of diurnal variations.

We tried to make the storage reservoir capable of flattening out the power variation as between spring- and neap-tide periods too, although we did not altogether succeed because the proposed reservoir could not be made big enough to do it.

Storage Considerations

The Ministry of Transport scheme was therefore at that time, and indeed as reviewed by the Brabazon Committee in 1933 still remained so, saddled with a huge capital outlay—estimated at £11½ millions—for providing the storage reservoir and plant on this extensive scale. It is very certain, however, that operating in present and, even more so, in probable future conditions the grid itself could be made to draft directly into industry a larger proportion of the intermittent power produced by the tidal turbines, so reducing the storage capacity called for and by the same token reducing the wasteful losses involved in the process of storing and regenerating the energy. Alternatively, the storage reservoir could be employed to a greater extent for equalising output as between spring-tide and neap-tide periods so improving the gross output of the whole plant.

The existence of the grid also opens up another line of considerable promise and this is the possibility of constructing a pumped storage reservoir or reservoirs for use in connection with the tidal power output situated in localities remote from the tidal turbines where physical conditions may be found even more favourable than those existing at Trelleck Grange. This possibility was brought out in the discussion which arose on the paper read before the Institution of Civil Engineers in December, 1942, by J. K. Hunter and R. W. Mountain, on "Some Economic Aspects of Hydro-Electric Development."

Although no important examples of pumped storage plants are to be found in Great Britain, considerable attention has, for many years past, been directed to this type of development in other countries, especially in Germany, Switzerland, France and Italy and, more recently, in Sweden and the United States. In the last few years, however, the advantages, in favourable circumstances, of increasing the peak-load capacity of interconnected steam and hydro systems by the use of pumped storage plants have become increasingly recognised by British engineers and several promising schemes of this type have recently been investigated.

Generally regarded, therefore, the prospects for the successful and economic exploitation of the project seem to be much brighter to-day than ever before, and the scope which exists for introducing into it all sorts of innovations, economies and improvements is very great. Had it been in operation it would have been worth many battalions to the country during the present war.

News from Australia

A CORRESPONDENT reports that damage to the value of nearly £70,000 was caused by a fire which broke out in the works of Electrical Plant Manufacturers, Pty., Ltd., Waterloo (N.S.W.). Seventy firemen had great difficulty in preventing the fire from spreading to adjoining factories.

In New South Wales domestic users have been asked to reduce the consumption of electricity by 20 per cent. Street lighting is also to be restricted, as well as all external lighting, and internal lighting of shops. In Melbourne, restrictions have been imposed on shop, building and street lighting. In Adelaide, where a voluntary economy was urged, there has been no reduction of any importance.

The Western Australian Minister for Electricity Supply has stated that the Government is giving consideration to a very considerable expansion of plant at the East Perth power house. The last unit installed (in 1938) consisted of a modern 25,000 kVA set and the additional equipment will probably be two similar units. Western Australian authorities are also investigating the establishment of a central power station in the south-west.

Delegates to the Federal conference of electrical trades unions, held in Adelaide recently, opposed the extension of dilution in electrical trades, unless reasonable overtime was worked. They also decided to request the Federal Government to call a federal conference of employers and the unions with the Controller of Electricity, with a view to establishing a common policy to be followed by State committees in the administration of the regulations for the control of electrical contractors, and the zoning and licensing of radio service men.

Load Analysis

Study of a 650-sq. mile Area

AN analysis of the load on a modern electricity supply network for the year ended June, 1939, based on a report (K/T 108) of the British Electrical and Allied Industries Research Association, has been presented to the Institution of Electrical Engineers by MR. P. SCHILLER (Electrical Research Association).

The area concerned is of 650 sq. miles, chiefly suburban, and of the 36 individual undertakings involved 31 belong to the Northmet Power Co. and the remainder receive supplies in bulk, the collective maximum demand being of the order of 300 MW. The population is 1·2 millions; of the 420,000 consumers, 92 per cent. are domestic, 7 per cent. commercial and one per cent. industrial. Of the 740 million kWh sold, 44 (25) per cent. is domestic, being 840 (620) kWh per domestic, 3,400 (3,000) per commercial and 40,000 (75,000) per industrial consumer, national averages being given in parentheses.

Effects of Lighting and Heating

The conclusions are that if there had not been any lighting or space-heating loads, the collective load factor would have been about 56 per cent., which is lowered by the addition of lighting to approximately 44 per cent., while the further addition of space heating makes the actual value 33·5 per cent. (39·5 per cent. excluding the cold snap), the respective increments in total number of kWh supplied being 30 and 29 per cent.

The load factor of the space-heating load on the particular system investigated seems to be lower than that of the lighting load; at most it is of the same order of magnitude. The daily load curve of the space-heating load produced by a cold day has two virtually equal peaks, one between 8 and 9 a.m. and the other from 10 to 11 p.m. The latter is caused by bedroom heating, being harmless because of good diversity in respect of the lighting peak. It is the morning peak that may be alarming; for once the system load is transformed to reach its maximum at that time, then any further disproportinate increase in space heating is bound to impress its inherent low load factor on that of the collective load.

Cooker Demand

With cooker saturation at 11 per cent. the mid-day household peak is still well absorbed by the lunch-time dip in factory load. Disregarding cold-snap conditions, the highest Sunday mid-day demand is 170 MW and the largest working day demand 256 MW; the margin of 86 MW (with an after-diversity maximum demand of 0·9 kW per cooker) would allow the connection of nearly 100,000 more cookers until the Sunday peak reached the working day peak, provided all the other component loads remained unchanged, the corresponding total cooker saturation rising to 37 per cent.

A striking feature is the insignificance of the water heating load, it being responsible for less than 3 per cent. of the total kWh and only 2 per cent. of the whole maximum demand. Since both cooking and water heating represent "basic" supplies, the importance of their cultivation by the supply undertaking is manifest.

The overall load factor of the domestic load involved cannot be estimated with any great accuracy. The maximum demand occurs between 8 and 9 a.m.; the corresponding demand due to cooking and water heating is about 15 MW, while miscellaneous small appliances may account for a further 5 MW.

There remains to be allocated a total of 192 MW (cold snap) or 134 MW (ordinary cold morning) attributable to lighting and space heating. Allowing 20 per cent. from non-domestic sources, which appears to be generous, then 154 MW and 107 MW would be respectively chargeable to the domestic load, making totals of 174 MW and 127 MW respectively. The corresponding energy figures are 352 and 346 million kWh, the resulting load factors being 23 per cent. with cold snaps and 31 per cent. without, which figures tally with previously expressed opinions.

The author concludes his paper with recommendations for further research in continuation of the same lines.

Underfeed Stokers

A MEETING arranged by the Institute of Fuel and the British Coal Utilisation Research Association will be held at the Institution of Electrical Engineers, Savoy Place, London, W.C.2, on Tuesday, March 28th, when a symposium of papers on "Underfeed Stokers" will be presented and discussed. The purpose of the symposium is to promote the interchange of knowledge and experience of problems relating to the use of underfeed stokers as applied to furnaces of all types, and to arrange for further collaboration between appliance makers, furnace builders and users towards the solution of their problems. The first session, from 10.30 a.m. to 12.30 p.m., will be devoted to summaries of papers (three by appliance makers, two by furnace makers and five by users) and these will be discussed at the second session from 2.30 to 4.30 p.m.

Occluded Gases

Their Elimination from Feed-Water Systems

By Vernon Walker, A.M.I.E.E.

THE amount of oxygen, carbon dioxide and ammonia permissible in the feed-water cycle is affected by the chemical composition of the boiler water and operating pressures. Oxygen may be introduced through leakage wherever the steam or condensate is below atmospheric pressure, through exposure of the condensate to the air as in surge tanks, and in the make up either in treated water or when supplied by evaporators. When oxygen or other gases are present in the boiler feed-water, they may also be present in the steam from the boilers.

Separate de-aerator heaters (either of the tubular or direct-contact type) often form part of modern feed-systems and provide one central point in the heat cycle for the removal of the dissolved gases. The amount of oxygen that can be retained in solution is proportional to the partial gas pressure and also depends inversely on the temperature of the water.

Methods of De-aeration

In the open or direct-contact type of de-aerator, gas is liberated by raising the feed-water to the temperature of the steam space through which it falls; at the same time a quantity of steam, in excess of that required for heating the water, is passed through the heater shell. As the boiling point of the water corresponding to the pressure is reached, the dissolved gases are driven out of solution into the current of steam passing over the surface of the water and ultimately pass to the condenser steam space, from which they are rejected by means of an air ejector.

In the tubular type of de-aerator heater the steam passes through the tubes, the water falling into the body of the de-aerator from either sprays or trays. When using the tray contact type, the corrosive attack on the trays and interior water distribution parts can be limited. In the spray type it is not clear that corrosion and erosion of the main tank structure can be prevented without awkward interior baffling. The steam employed is generally extracted from the turbine, and the pressure usually changes automatically with changes in extraction pressure or turbine loading. This is generally satisfactory, although in some cases de-aeration has been adversely affected by fluctuations in the temperature of the feed-water.

In many cases a sufficiently low oxygen content is obtained by relying entirely on the condenser for de-aeration. In some of the older condensers the removal of oxygen has not been satisfactory, but in modern designs it is believed to be as complete as possible, and values as low as 0·005 cc. per litre have been recorded over long periods.

Contamination due to open surge tanks does not appear to be prevalent, provided the water level does not fluctuate rapidly. In some cases floating covers have been fitted to the surge tanks to minimise oxygen absorption. These covers also prevent severe rusting of the tanks. Steam sealing is not always successful, as oxygen absorption cannot be avoided unless the surface of the water is heated fully to boiling point, which usually requires liberal venting, especially if the entering condensate is appreciably below 212 deg. F. Steam pressure must never become even slightly negative.

Oxygen in the discharge from the low-pressure heater drain pumps has been remedied by embodying in the heater a specially designed de-aerating hot well, the steam being supplied from the flash from the intermediate heater drains.

De-aerating and re-heating hot wells have also been fitted to condensers, which not only de-aerate the heater drains, but elevate the condensate temperature sufficiently above the exhaust steam temperature to recover a large portion of the heat in the heater drains.

Oxygen Content

"Condensate depression" is generally understood to relate to the difference in temperatures of the steam at the turbine exhaust and of the condensate. There is no direct relationship between "condensate depression" and oxygen content, as is commonly supposed; for instance, if a condenser is designed and operated to give zero depression, oxygen may be present in a large amount if the extraction pump has a leaky gland. Conversely, a condenser designed to operate with a measurable pressure drop, and consequently a finite condensate depression, may show zero oxygen content.

The maximum quantity of gas that can be dissolved, as opposed to entrained, depends upon how much the temperature of the liquid is below its boiling point at the absolute pressure existing at the surface of the liquid. In a condenser this relation is termed "under-cooling." The degree of under-cooling is not related to steam temperature, but rather to the pressure at the base or hot well of the condenser.

Under-cooling is, in turn, only an imperfect guide to the magnitude of the oxygen content, since hot-well pressure determines the amount

of dissolved oxygen per degree of under-cooling. For instance, if the condensate at the base of the condenser is 2 deg. F. below the temperature corresponding to the steam temperature at the pressure existing at the surface of the liquid, with a pressure at the surface of 0·5 in. Hg, the amount of oxygen that can be dissolved is 0·008 cc. per litre, but if the absolute pressure at the surface is increased to 0·3 in. Hg with 2 deg. under-cooling, the dissolved oxygen content can be increased to 0·025 cc. per litre.

Taking the same pressure conditions with 6 deg. F. under-cooling, the oxygen solubility will be raised to 0·024 and 0·075 cc. per litre respectively. Eliminating other factors, high vacuum favours low oxygen content and *vice versa*. Therefore, high oxygen content under high vacuum conditions must be accompanied by severe under-cooling, unless mechanical entrainment of air in the condensate is responsible.

A well-designed condenser operating under load with efficient air removal equipment will have complete penetration of steam flow throughout the length and depth of the tube bank. Without any air pockets or air-blanketed tube surface there can be no under-cooling and consequently no dissolved oxygen, although there may be a measurable condensate depression.

Removing Ammonia

The elimination of ammonia from the feed-water system has been receiving increased attention due to numerous cases of corrosion attributed to its presence. Ammonia may be formed by the decomposition of organic matter, nitrates or nitrites, in the raw water, either in the evaporator or in the boiler. Since ammonia is very soluble, it may become concentrated in the condenser by reabsorption in the air ejector inter-coolers and after-condenser, the condensate from which is usually trapped back to the condenser. In one instance in which the circulating and make-up water for a 35,000-kW turbine is drawn from a river, considerable trouble from ammonia was experienced.

The two-pass surface condenser of 34,000 sq. ft. is fitted with arsenical copper tubes. Five closed heaters are used in the feed cycle, the drains being cascaded and the heaters vented to the condenser. Boiler make-up is supplied by evaporators, which are fed with raw river water. Failure of a number of tubes in the condenser was due to the corrosive action of the ammonia on the steam side. The steam flow in the condenser is downwards through the tube bank in the central section and upwards at the end or air-cooling sections. Cooling water nters the top of the condenser, flows first through the tubes in the upper half, reverses in the back water box and then passes through the tubes in the lower half. Attack on the tubes was confined entirely to the air-cooling sections on the steam side. There was also an attack on the tube sheets of Muntz metal near the air-cooling sections.

Tests for ammonia content at various points showed the following:—Raw river water, 5 to 12 ppm; steam from boiler, 4 ppm. (pH value 9·9); condensate from hot well, 3 ppm. (pH value 9·8); drain for air ejector after-cooler, 50 to 220 ppm.

With the cycle employed corrosive gases are removed only in the main condenser through the air ejectors; when they are not removed they can be re-dissolved in the condensate and returned to the boiler and concentrate in the system.

It is impossible to remove completely the ammonia in the condenser. The position has been relieved somewhat by an open-type heater in the cycle, the correct location of vents and the passing to waste of highly charged drains from such apparatus as the air ejector and open-heater vent condenser. The only complete solution appears to be a source of make-up free from ammonia or albumenoid nitrogen.

In another installation, after the condenser had been leaking sufficiently long to contaminate the condensate to the extent of 1·5 to 2 ppm. salts, as recorded by a conductivity meter, NH_3 was found to be present as follows: Evaporator condenser drain, 0·3 ppm.; hot-well water, 0·12 ppm.; ejector after-cooler, 0·6 ppm.

Since ammonia appeared to concentrate in the condensate of the air ejector after-cooler, this was allowed to run to waste in view of the small amount of water involved.

Twin Branch Power Station

SINCE April last year the 2,500 lb. per sq. in. generating plant at Twin Branch station of the American Gas and Electric Co. has been operated under full designed conditions. At the last meeting of the American Society of Mechanical Engineers (November 29th to December 4th) its thermal efficiency was said to have reached 34 per cent. In a report appearing in the *Electrical World*, the availability factor of the unit is given as 96·7 per cent. The high-level natural-circulation boiler, which has an evaporation capacity of 550,000 lb. per hr. and supplies steam at 2,300 lb. per sq. in. and 950 deg. F. to a 76,500-kW turbo-alternator, was described in the *Electrical Review* of December 26th, 1941, after it had been in commission about nine months. Since then the plant has been taken out of service twice for modification. Circulation tests have shown values exceeding the calculated performance and it is claimed that the problem of providing adequate natural circulation has ceased to exist. Steam purity is said to be at least as good as with units operated at up to 1,400 lb. and turbine-blade deposits are no more than at 1,250 lb. A slow building up of a stage pressure in the high-pressure unit is corrected by dropping the primary steam temperature to about 750 deg. F. for two or three hours.

Domestic Apparatus—IV

Survey of Probable Cooker Development

OF all the electrical appliances employed in the home, the cooker comes in for the greatest amount of criticism. Most of this is unjustified and results from lack of knowledge, conservatism or incorrect methods of use. Despite the high degree of efficiency reached in the design of present-day apparatus, however, there is undoubtedly still plenty of scope for inquiry into possible improvements. Some of the modifications desirable, particularly in the interests of kitchen planning and improved service and maintenance, have already been touched upon, namely the standardisation of dimensions and method of fixing of wearing parts (hotplates, oven elements, etc.) and the defining of overall heights and depths.

Although some would like to get right away from existing designs, our general impression from talks with a large number of engineers, manufacturers and consumers is that there is not much wrong with the lay-out as a whole though designs might be cleaned up generally and individual components improved. A "streamlined" cabinet type of construction, perhaps with a tall splash-plate arranged to shut down and form a table-top lid, is generally favoured, and the simpler and more robust the design the better, both from the use and maintenance points of view.

In our last issue the probable trend of domestic appliance design generally was discussed. This week we concentrate on the apparatus that provides the most opportunities for controversy—the cooker

The question is raised whether a pressed steel construction might not be used to a greater extent, perhaps employing stainless steel for certain parts. There is a considerable demand for an additional hot cupboard or a cupboard for utensils underneath the oven, since if the grill is being used there is no room in the normal hot-cupboard for plates: in any case the hot-cupboard is usually far too small for its purpose in most of the smaller cookers, and there is something to be said for the contention that the grill compartment should be quite separate. Certainly the grill pan should have heat-insulated handles.

Short legs rather than flush fitting to the floor are generally considered preferable from the cleaning point of view, though not so good for achieving the most effective scheme of kitchen planning. To obtain uniform height with other kitchen equipment it is suggested that the legs might be adjustable. Where table top space is lacking near the cooker, extension hobs would be useful not only for resting saucepans but also for the electric kettle.

If the size of the kitchen of the future permits, there is much to be gained by placing the oven at the side of the hob. This position does away with stooping and provides an extra working space on the top, as well as greatly facilitating cleaning. The drop-down oven door appears to be gaining supporters and, provided that a sufficiently robust hinge is employed, has much in its favour. It furnishes a handy place for inspecting dishes taken from the oven, and obviates the necessity for supplying cookers with both left and right hanging doors.

Easy cleaning is very important. Besides eliminating as far as possible all sharp corners, protrusions and crevices, as many components as practicable should be completely removable. It has been suggested that it should be possible to detach not only the hob equipment and the oven interior, but also the oven and the warming cupboard doors, the base of the hot-cupboard and the top of the oven. The oven racks should be more easily cleaned.

One of the few criticisms we have come across about ovens in the smaller cookers is that they are too deep and not wide enough. It is suggested that instead of the customary 14 in. a width of 16 in. might be adopted as in the United States and Canada. When comparing the sizes of electric and gas ovens the fact must not be overlooked that in the latter the 6 inches at the bottom are unusable. Plug-in oven elements assist maintenance.

Three-heat switching, if used intelligently, provides a very efficient means of control, but it is felt that thermostatic control should be incorporated if only because it simplifies operation. The lack of it is undoubtedly the reason why some housewives still prefer gas. The extra cost of automatic control is insignificant spread over a number of years, and the objection that the use of the device introduces an unnecessary complication no longer carries much weight, so reliable are present-day thermostats. But a cooker intended for thermostatic control must be specially designed. It is not sufficient just to put a thermostat in any type of oven. The further addition of time control may well become a standard fitting.

It is in connection with hob equipment that we find the greatest difference of opinion. It is by no means certain that the hotplates and grill boiler with their tops flush with the cooker top are the last word. Cavities to hold utensils recessed in the hob, as embodied in certain American and Canadian cookers,

might provide a better solution. Assuming that the existing arrangement is the best that can be devised, it is fairly generally agreed that diameters of hotplates and methods of fixing should be standardised, but even so we still come across suggestions for special small diameter plates, either for quickly heating small utensils or for simmering. But it is quite easy to design a standard size of plate with a special centre portion.

There is still no reliable indication as to what will be the type of plate ultimately adopted. The solid plate still has the greatest number of adherents on account of its robustness, long life and ease of cleaning. If the special utensils required were made available at lower prices its principal disadvantage would be overcome. While this type operates reasonably satisfactorily with any kind of utensil, experiments undertaken by one large undertaking have shown that the average life of the plate is thereby reduced to as little as one-fifth of the normal.

With the present tendency towards a fairly high loading of 1,800 W or more, there is little cause for complaint with regard to slow initial heating. The use of new materials may make it possible to raise the loading without impairing the life of the plate and to overcome corrosion troubles. It may also help to avoid warping due to leaving the plate uncovered or to the use of unsuitable utensils. The same result could be achieved by employing a safety device. The aim must always be towards improvements which will enable the plates to be used *anyhow*.

From the point of view of immediate response, the ability to use any type of utensil, the avoidance of damage to the plate if left on, and perhaps above all the "psychological" aspect, the radiant plate, whether it be of the tubular sheathed element, transformer or Backer-Jackson type, has a considerable advantage over the solid type.

Methods of Control

One further development might very materially affect the design of hotplates, namely, improvements in methods of control. The call for facilities for simmering is growing. Four-heat control is satisfactory, but infinitely variable thermostatic control is regarded as inevitable. Those who oppose this point out that only two extreme conditions are required —quick boiling and simmering—and that the extra cost is not justified by the advantages gained. It has to be admitted that in this matter of control the electric cooker finds itself at a certain disadvantage as compared with its gas counterpart. Should it be decided to introduce this new feature the immediate heat response necessary seems to point to the use of a radiant type of plate.

For ease of inspection and repair the control switches might be accommodated in a self-contained removable panel. The housewife would find it more convenient to have this arranged horizontally above the oven instead of at the side, but it is somewhat difficult to plan this in relation to the drop-down grill compartment door. A suggestion that pilot lights should be provided for every switch appears unnecessary, although one is desirable on the main control panel. This panel might be mounted on the wall rather than incorporated in the cooker, since it is safer and provides a convenient distribution point for other appliances. An automatic pilot light inside the oven would be a convenient but non-essential addition.

The desire to meet the demand for a wide variety of colours will no doubt have to be tempered by practical considerations and, although it might be possible to conform to standard colours fixed for kitchen schemes, a limited number of neutral colours will probably have to suffice. The finishing of the insides of the ovens, etc., in a light colour would encourage thorough cleaning.

The heat storage cooker has great possibilities and still has many advocates. One advantage of having an oven always hot and ready to use is, however, somewhat negatived by the fact that the consumption is very much higher (perhaps 2,500 kWh a year more). Other developments may occur in the field of the high-frequency induction cooker, but so far as we are aware there has been none lately.

Electric Kettles

With regard to the kettle, which is not employed to any great extent in some other countries, Great Britain should continue to hold its position as the largest producing country in the world. There seems a general opinion that the days of the clamp-on kettle element are over and that the immersion type has indisputable advantages, particularly in regard to possible damage through being left switched on. As so few breakdowns occur it is questioned whether a safety device is necessary, though any refinement aiming at keeping the apparatus in service and avoiding maintenance is to be desired.

With a fairly high loading of, say, 1,500 to 1,800 W for a three-pint model, an electric kettle is, despite widespread belief to the contrary, faster than gas. With regard to constructional materials, aluminium, probably chromium-plated, will certainly continue to grow in popularity, thus replacing copper. The optimum size of lids seems to be in dispute. Generally the tendency is for them to be larger, but an objection to this is that it is found in a few cases that the kettles are being used as saucepans for vegetables, etc., to the detriment of the elements and the interiors generally. It is possible that lids could be done away with. Could not the spouts be large enough for filling purposes?

Our final article in this series will deal with other types of domestic appliances.

Hydro-Electricity

One-Fifth of Requirements Might be Produced

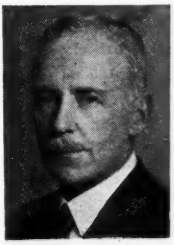
THE third Cantor Lecture of the 1944 series was delivered at the Royal Society of Arts on March 6th by Sir William Halcrow, who dealt with the application of surface water resources to the production of electric power. The British Aluminium Co. was, he said, the first undertaking to develop a scheme of any size in this country—6,700 HP at Foyers, Loch Ness, in 1896. A few years later the Aluminium Corporation built its Dolgarry station in North Wales and by 1914 had two further stations, one at Cwm Dyli nearby and the other (30,000 HP) at Kinlochleven in Scotland.

In 1921 the Water Power Resources Committee advocated the fullest utilisation of water in this way and in 1921 the British Aluminium Co. obtained powers to construct the Lochaber station of 120,000 HP. The first of the larger Scottish developments for the public supply of electricity was carried out in the Clyde Valley in 1926, and in 1927 the Grampian Co. also started the construction of extensive works. The Galloway scheme, with five stations opened in 1935 and 1936, was sanctioned in 1929, in which year the Glen Affric and West Highlands schemes were rejected by Parliament. The Caledonian Power Scheme, designed for the production of calcium carbide, was similarly rejected in 1936, 1937 and 1938, as was a second Glen Affric scheme in 1941. The cost of promoting a Bill of this kind might be as much as £30,000. The last two projects would have brought the total continuous output from water power in Scotland to 350,000 HP. Following the recommendations of the Cooper Committee, the Scottish Hydro-Electric Board was formed last year.

Cost of Distribution

Sir William admitted that during the construction of large dams the flow of rivers might be disturbed, but he contended that the surrounding land would be soon restored and that any disfigurement of scenery would be only temporary. Where factories could be established close to the sites, large quantities of power could be obtained cheaply, but this did not apply to domestic uses, since the cost of distribution common to water-power and steam formed much the largest part of the total cost of electricity.

Investigations carried out before the war, he said, showed the cost of steam power near a coalfield with coal at 15s. per ton to be twice that of water power. The financial life of water-power works could be taken at 75 years during which, if the capital were paid off in annual instalments, the interest charge (making up with sinking fund the bulk of the annual charges) would fall, so that at the end of the period the cost of electricity would be very small, whereas steam plant had to be renewed, say, every twenty years and the cost of coal was likely to increase. Over one million turbine HP might be continuously available from Highland water - power, though some of the plants would be small. Returns to the existing companies in the Highlands had not been high, amounting in the case of the Grampian Co. to a little over 3½ per cent. on £6 million over ten years.



Sir W. T. Halcrow

No insuperable difficulties stood in the way of using tidal power. A large rise and fall of tides was requisite. A maximum of 47 ft. was found at the most promising site, which was at the Severn Estuary. The first proposal for a barrage there was made in 1849, though not for generating electricity. It was not until 1917 that a scheme for the latter purpose was prepared by the late C. S. Meik, who projected a barrage at Beachley, just above the confluence of the Wye, with a turbine dam to generate power on the outgoing tide, and a regulating reservoir at Treleck Grange. The capacity of the plant was to be 750,000 HP. The Ministry of Transport's scheme in 1920 suggested a site at English Stones and a further Committee (Lord Brabazon's) reported in 1933.

The chief difficulty in using tidal power was due to the variation of power output with tides twice each day and to the advance of the period of high tide by about one hour each day; also more power could be produced at spring than at neap tides. Storage entailed great loss of power in pumping, but increasing consumption of electricity and the existence of the grid might provide a more economical solution.

A diagram was presented to indicate that when the tide had risen to its full height and the gates were shut and the water downstream of the barrage was allowed to fall for a distance of 9 ft., the turbines could be started and would continue in operation

until the difference in level between the impounded and tidal water was again about 9 ft., the sluice gates being opened when the rising tide below the barrage reached the level of the impounded water. An alternative to water storage would be steam stations to operate at different periods each day as the tides advanced. Another was the use of surplus energy for heating water in large tanks situated in towns for the use of their inhabitants. Present calculations showed that the Severn Barrage and Scottish schemes could produce about one-fifth of the post-war electricity requirements in Great Britain, of which the former would furnish rather less than half.

NEW BOOKS

Heat Engine Textbook. Fluorescent Lighting Practice.

Thermo-Dynamics Applied to Heat Engines. By E. H. Lewitt. Pp. 494; figs. 185. Sir Isaac Pitman & Sons, Parker Street, Kingsway, London, W.C.2. Price 25s. net.

Lewitt's "Thermo-Dynamics" is already deservedly popular with engineering students as witness the fact that the book has reached its third edition in a period of little more than ten years, and in view of recent developments—more, it must be admitted, in connection with the internal combustion engine than with the steam turbine—a considerable amount of revision and enlargement has been found necessary. This concerns mainly combustion problems in the i.c. engine and the effects of the variation of specific heat of gases, although new work has been added on air cycles and refrigeration.

It is greatly to be regretted that the author has not seen fit to include some reference to the internal-combustion turbine which was gradually assuming practical shape even before the outbreak of war. Admittedly much of this work is now on the secret list, but a survey of the inherent difficulties underlying the development of this type would not, we suggest, have been out of place. It can be argued that just as the steam turbine has found its principal application to the driving of electric generators to the complete elimination of the steam reciprocator for this purpose, so too, after the war, the i.c. turbine may well find its chief advocates among electrical engineers.

For the rest, the underlying theory of the steam turbine is adequately dealt with and, covering the examination for the London University engineering degree as well as that of the associate membership of the Institution of Electrical Engineers, the book merits a place in the library of every electrical engineer. With its examples taken from the recent examinations of these and other bodies (with numerical answers where called for), the student will find it invaluable.—A.R.

Fluorescent Lighting. By A. D. S. Atkinson. Pp. 144; figs. 84. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 12s. 6d.

Very few books dealing with illumination have been published in this country during the last few years. The present work represents a refreshing treatment of a rapidly advancing subject.

Sufficient information is given in the first three chapters to enable the reader to understand clearly the process of obtaining visible light as a result of the impinging of ultra-violet radiation on fluorescent materials. Various applications of fluorescence are discussed, followed by a detailed account of the 80-W, mains-operated fluorescent lamp. The electrical circuit of this light source is naturally more complicated than that of a normal incandescent lamp, and consequently the former may occasionally be erratic in behaviour. A useful summary is given of the troubles which may be experienced, together with the steps to be taken in order to remedy them.

The fittings designer will be interested in Chapter V which deals, in a general way, with the design and performance of fluorescent lighting fittings. One probable result, arising from the introduction of the tubular lamp, will be the installation of continuous lines of fittings, in instances where high levels of illumination are required in industrial interiors. For commercial application, it seems likely that louvres will be used, in order to avoid possible irritation due to glare from bare lamps. Stress is laid on the comparatively small amount of radiant heat emitted by the fluorescent lamp; this characteristic becomes especially advantageous where food shops or factories are concerned.

The author includes data enabling lighting installations to be correctly planned and points out the importance of studying the methods of mounting the fittings in order to minimise the production of shadows. In the main, fluorescent lighting practice in this country has been confined to commercial and industrial interiors and examples are given showing typical factory installations. Illustrations of American practice are also given and these show the effective installation of fluorescent lamps, of various colours and sizes, for the illumination of offices, shops and houses.

Post-war lighting development in Great Britain will be based on the extended use of fluorescent lamps, which will eventually be manufactured in a variety of wattages and colours, as is the case in America. It is hoped that when the time comes for the publication of the next edition of this book, details of a wide range of fluorescent lamps will be available for inclusion.—J. B. H.

Shorter Notices

The Principles of Electrodeposition. (The Electro-chemistry of Electro-plating.) By Samuel Field, A.R.C.Sc. Pp. 314; figs. 85. Sir Isaac Pitman & Sons, Ltd., Parker Street, London, W.C.2. Price 25s.

Plastics: Scientific and Technological. By H. Ronald Fleck, M.Sc., F.I.C. Pp. 325; figs. 80. Temple Press, Ltd., Bowling Green Lane, London, E.C.1. Price 25s.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Electricity Supply Reorganisation

THE statements made by Mr. DeRenzi in his letter last week are so contrary to facts that I must crave your indulgence to make the necessary corrections. He takes his stand on the five main points enumerated by Lord Portal on June 17th, 1942. The Joint Memorandum offers his Lordship precisely nothing in regard to his five points. Let us examine them one by one.

(a) " To secure a better diversity of load." I can find no reference to this in the Joint Memorandum and, of course, there cannot be any as the clear intent of the Joint Memorandum is that each undertaking shall be left undisturbed. The industry has always been agreed on this.

(b) " To secure a greater standardisation of voltage." Paragraph 32 of the Joint Memorandum proposes that the Minister of Fuel and Power shall be given the compulsory powers already possessed by the Electricity Commissioners of causing an undertaking to standardise its system. No offer here.

(c) " To work towards a uniformity of charge throughout the country." On this the Joint Memorandum proposes another committee of inquiry, overlooking the fact that the Electricity Commissioners did this in 1929 and endorsed the report published in 1930, which report has recently been further endorsed by a Committee of the Institution of Electrical Engineers. No offer to Lord Portal that the industry will *accept* any report, since the Joint Memorandum proposes it must be obligatory—compulsion and not willing agreement.

(d) " To adopt a common policy with regard to development." Paragraph 60 of the Joint Memorandum recommends obligatory contributions to E.D.A. and no offer of 100 per cent. voluntary membership. Paragraph 47 of the Joint Memorandum recommends organised co-operation through area committees which would *ensure* the carrying out of items of national policy, but in paragraph 50 it states that these area committees would act in an *advisory* capacity. They cannot, therefore, function as stated in Paragraph 47. Seven items are specified in the duties of the area committee, on which it may make recommendations. Paragraph 52 requires the Electricity Commissioners to hold an inquiry if any recommendation *appears* to be detrimental to any undertaking concerned. If the recommendation relates to the ownership of the undertaking, an appeal can be made to the Minister of Fuel and Power, and finally the Minister's Order must be approved by Parliament. Is this any new offer or proposal on the matter. and where is any offer to Lord Portal in regard to development ?

(e) " To put the best engineering advice at the disposal of all distributors." Presumably Paragraph 50 (o) is the answer to this, but the proposal is of a limited character and confined to undertakings within the area and not " all distributors."

No, Mr. DeRenzi, you must try again; obviously, as you do not own a selected generating station, you are not very concerned, or on any other matter, except to retain your undertaking as an individual entity, and equally obviously it is easy to agree on those matters about which you have had no real disagreement in the past.

" A. DE-BUNKER ".

THE letter from Mr. Purse headed " Only Lighting " in your last issue (p. 339) is timely and his last sentence sums up the manner in which the proposed reorganisation of our industry is being handled.

On the same page Mr. DeRenzi under Section 3 of his proposals hopes " that we shall not quibble about minor points," but unfortunately under Section 5 he, as a member of the committee responsible for the Joint Memorandum, did not trouble to ascertain the views of the majority of selected station owners before issuing the I.M.E.A's independent proposals for ownership of generating stations. This is no minor point.

I note that he is apparently not very concerned in this matter, for he suggests that the selected station owners themselves could put forward a satisfactory alternative scheme. Surely this is what the selected station owners desired, but unfortunately the appropriate I.M.E.A. committee did not deem such a course desirable. Mr. DeRenzi is quite correct when he states that the Joint Memorandum was approved by the accredited representatives of over 85 per cent. of the whole industry, but he should bear in mind that in so far as municipal undertakings are concerned, selected station owners distribute some 75 per cent. of the energy, whereas about 85 per cent. of the members of the I.M.E.A. who have votes do not own a power station.

Many suggestions are being put forward for the reorganisation of the industry, but in my opinion if it is to be efficient and happy it must be a united industry. Within recent years both large and small nations have come to realise the true meaning of the word "united."

Bradford. T. H. CARR.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

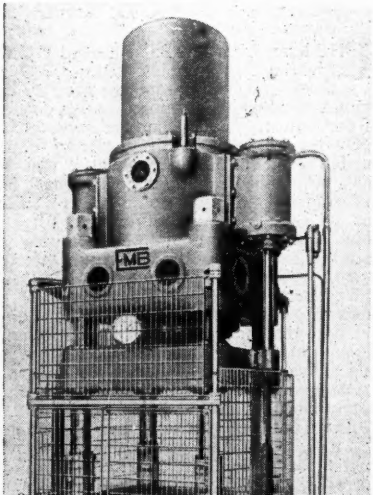
Moulding and Pressing Machine

A DUAL-PURPOSE machine recently put on the market by the E.M.B. Co., Ltd., Moor Street, West Bromwich, although designed primarily as a compression moulding press, will also serve for rapidly producing (with soft metal dies) light alloy sheet metal parts.

The machine is of the down-stroke type and can be operated by either of two pressures, controlled by means of a single lever. With an air supply of 150 lb. per sq. in. the light down pressure exerts a force of 7½ tons and further movement of the lever adds 150 tons, which is available for 2 in. and can be applied at the end of any length of stroke up to a maximum of 12 in. If necessary, the high pressure can be re-applied without raising the platen and thus a further distance can be traversed. The light pressure is powered by direct-acting air cylinders mounted on the side of the head, but the heavy pressure is obtained by an oil intensifier system.

A reducing valve, provided for fitting in the air supply line, stabilises the high pressure and also serves as a means of adjusting it to suit the work in hand. The light return pressure gives a lifting force of 6 tons. The air valves are of the poppet type with moulded synthetic seatings. Cams fitted to the control lever shaft operate the valves and thus give the operator full control of the speed of the down and up strokes of the platen.

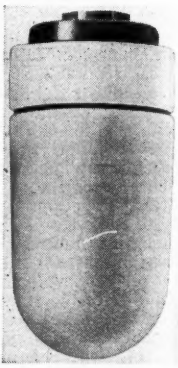
The distance between the bars either way is 24 in., but as the overall size of the table is 38½ in. by 44 in. advantage can be taken of one of the larger dimensions in determining the size of die accommodated. Facings are machined on all four sides and on the underside of the table for carrying cylinders and mechanism for ejection, core manipulation, etc. The wire mesh safety guard is padlocked at the rear. Access to the work table is by pulling the gate forward and sideways, causing it to fold in half.



Dual-purpose moulding and pressing machine

Watertight Lighting Fitting

The first model of a new range of watertight lighting fittings to be announced by Rowlands Electrical Accessories, Ltd., "Real" Works, Hockley Hill, Birmingham, 18, is suitable for a 60- or 40-W lamp. It is 8 in. high and 4 in. in diameter. The top portion is a non-corrodible zinc alloy die casting which engages with a rubberised asbestos washer and is secured to the porcelain body with two non-ferrous screws the holes of which are arranged with 2 in. centres. The porcelain body, complete with the lampholder, is made in one piece; there are therefore no interior fixing screws, nipples, locknuts or washers. The globe is made of pressed flint glass, by contrast with ordinary screw neck glasses which are normally blown and are of relatively light weight. The glass-pressing process not only allows for much heavier weight, but also provides a far greater degree of accuracy on the threaded portion than is obtainable with the blown variety. Consequently a positive watertight joint is obtained when the globe is screwed against a heavy washer. To facilitate mounting in positions where headroom is limited the fitting can be supplied without the top die casting, thus enabling it to be screwed direct on to a wooden pattress or standard conduit box, thereby easing wiring and simplifying erection by comparison with the older cast-iron type.



Pressed glass non-corrodible fitting

PERSONAL and SOCIAL

News of Men and Women of the Industry

CONSEQUENT on the death of Mr. W. C. Lusk, the deputy chairman and managing director, the following changes and appointments in the organisation of Associated Electrical Industries, Ltd., have been made:—

Sir George E. Bailey, Mr. H. N. Sporborg and **Mr. P. S. Turner** have been appointed vice-chairmen of A.E.I. and members of the executive committee of the board. Sir George Bailey has been appointed chairman of the Metropolitan-Vickers Electrical Co., Ltd., Mr. Sporborg has been appointed chairman of the British Thomson-Houston Co., Ltd., and Mr. Turner will be appointed chairman of the Edison Swan Electric Co., Ltd., Edison Swan Cables, Ltd., and Ferguson Pailin, Ltd.

Sir George Bailey

Mr. H. N. Sporborg

Mr. P. S. Turner

Mr. I. R. Cox

Mr. I. R. Cox has been elected a director of the Metropolitan-Vickers Electrical Co.

Mr. J. Webb, C.B.E., M.C., general manager of the Egyptian State Telegraphs and Telephones, Cairo, has been awarded the C.M.G. for services in the provision of communications for the Forces in the Middle East.

Mr. J. G. N. Strauss, M.P., has joined the board of Hubert Davies & Co., Ltd., and **Mr. H. M. MacLarty** has been appointed alternate for Mr. Roland Paget.

Dr. R. E. Stradling has been appointed to the newly created position of Chief Scientific Adviser to the Ministry of Works. He will retain his post of Chief Adviser in Research and Experiments to the Ministry of Home Security.

Chiefs of the main departments of Liverpool Corporation last week made a presentation to **Mr. P. J. Robinson**, the retired city electrical engineer. The gifts, which were handed to Mr. Robinson by the Town Clerk, consisted of an illuminated copy of a resolution passed by the City Council and a cheque.

At the annual general meeting of the Institute of Export the retiring president, **Mr. Leslie Gamage**, vice-chairman and joint managing director of the General Electric Co., Ltd., was re-elected for the ensuing year.

In a display of handicrafts in the Birkenhead Corporation Electricity Showrooms many members of the staff of the Department had exhibits. **Mr. F. W. Brecknell**, the borough electrical engineer, had on view a brooch made of mother-of-pearl, ivory and gold, which he had made; **Mr. W. A. Crocker**, the deputy borough electrical engineer, exhibited a fine example in woodwork, in the form of a folding tray.

At the annual meeting of the Eastern Section, South-East and East of England Area, of the British Electrical Development Association **Mr. A. Wade**, resident engineer and manager East Suffolk Electricity Distribution Co., Ltd., was elected chairman, and **Mr. G. P. Dixon**, borough electrical engineer of Colchester, vice-chairman.

Mr. S. I. Ellis, engineer of the Lighting & Heating Department of the North Eastern Electric Supply Co., Ltd., has been elected to serve for a fifth year as chairman of the Northern Counties Area and **Mr. E. E. Daniel**, borough electrical engineer of Darlington, has been re-elected vice-chairman.

Mr. R. H. Harral, borough electrical engineer, Blackburn, has been elected chairman of the North-West England and North Wales Area Committee of the Association in succession to Mr. J. E. Shepherd (Barrow-in-Furness).

Mr. C. F. K. Hague

Mr. C. F. K. Hague, deputy managing director of Babcock & Wilcox, Ltd., has been appointed British member of the Combined Production and Resources Board's Public Utilities Committee. Mr. Hague will leave this country shortly to take up his new duties. The Committee was formed last December to recommend to the Board such action as might be necessary concerning requirements, supplies and production of equipment to re-establish electric, gas and water services in liberated and conquered areas.—*Reuter.*

Mr. B. L. Metcalf, B.Sc., M.I.E.E. (Pengam), has been nominated as president of the South Wales Branch of the Association of Mining

Electrical and Mechanical Engineers, with **Mr. T. R. Thomas,** B.Sc., M.I.E.E. (Cardiff), and **Mr. T. G. Dash,** A.M.I.E.E. (Aberbargoed), as first and second vice-presidents.

In more normal circumstances the Birmingham Electric Club has usually held its annual dinner about this time of the year. This year, on the day of its annual general meeting, the Club arranged a luncheon at the Grand Hotel, which was very well attended and generally a success. The President, **Mr. A. M. Fletcher,** was in the chair, and proposed "The Guests;" this was responded to by Mr. E. B. Banks (English Electric Co.) and Mr. F. W. Lawton, chief engineer and manager of the Birmingham Electric Supply Department. A collection for the E.I.B.A. realised about £17.

Sir Gilfrid Gordon Craig has been appointed a member of the London Passenger Transport Board for three years from February 21st last in the place of the late Col. Forrester Clayton.

Mr. R. F. Cook, chief process engineer with the Brush Electrical Engineering Co., Ltd., has resigned to take up the appointment of works manager with Craven Bros. (Manchester), Ltd.

Mr. R. Davison, superintendent of lighting, Newcastle-on-Tyne Electricity Department, is to retire at the end of next month under the age limit.

Mr. J. B. Higham (Metropolitan-Vickers Electrical Co., Ltd.) has been nominated for the chairmanship of the I.E.E. North-Western Students' Section for 1944-45.

Mr. R. Gillespie Williams, of W. J. Furse & Co., Ltd., Nottingham, gave his lecture on "The Poetry of Light" to the Sheffield Centre of the Illuminating Engineering Society on March 6th. This was the fourth occasion on which he had lectured on this subject to I.E.S. Centres this session. The meeting was under the chairmanship of Mr. J. T. Grimshaw and nearly 200 people attended, including the Lord Mayor and Lady Mayoress of Sheffield. On behalf of the Sheffield I.E.S. Centre the Lady Mayoress presented a cheque for the *Sheffield Telegraph* War Fund to Mr. H. L. Cooper, director, Sheffield Newspapers, Ltd.

Obituary

Mr. W. C. Lusk.—A distinguished gathering attended the memorial service to the late Mr. William C. Lusk, chairman of the B.T.H. Co. and deputy-chairman and managing director of Associated Electrical Industries, Ltd., at St. Michael's, Cornhill, on March 8th. Sir Felix Pole (chairman, A.E.I.) was present with other directors and chief officials of the A.E.I. and constituent companies. There were also representatives of other leading electrical companies and organisations.

Mr. W. H. Glaser.—The recent death is reported of Mr. William Henry Glaser, M.A. (Cantab), A.M.I.E.E., chief research engineer of C.A.V., Ltd. He had been in the company's service for nearly twenty-three years.

Mr. F. W. Money, late of the head office staff of the General Electric Co., Ltd., died on March 5th.

Mr. R. F. Ferguson.—The death occurred at Salisbury, on March 2nd, of Mr. Russell Forrester Ferguson, M.I.E.E., M.I.Mech.E., of Hastings. He was eighty-three years of age.

Mr. C. F. McInnes.—We hear with regret that Mr. C. F. McInnes, formerly borough engineer of Gravesend, died at his home in that town on March 9th, after a short illness. Mr. McInnes was appointed to Gravesend in 1902 and retired in 1939. Before that he had been chief engineer and manager at Llanrwst and at Rhyl. He was educated at Wyggeston School, Leicester, and at Battersea Polytechnic. The Ministry of Fuel and Power states that since the inception of its scheme for improving the efficiency of fuel-burning plant in large establishments, Mr. McInnes had assisted materially by his inspections of many plants in the South-East Region.

The late Mr. C. F. McInnes

Mr. R. W. T. Corbett.—We regret to announce the death on March 8th of Mr. Robert W. T. Corbett, cable sales engineer for Siemens Electric Lamps and Supplies, Ltd. Mr. Corbett joined the company in May, 1902, and spent many years representing it in Singapore, Rangoon and India. In the last war he was a captain in the London Electrical Engineers and afterwards went to India to superintend a large electrical installation at a cement works. Subsequently he joined Martin & Co., Bombay, managing agents for a number of Indian electricity supply undertakings. He was resident engineer for them at Jubbulpore and carried out the original installation of a generating station and distribution system. He came home in 1930, and rejoined Siemens. He was sixty-one.

Mrs. H. Allcock.—We learn with regret of the death at her home at Hale, Cheshire, on March 2nd, of Mrs. Grace Allcock, the wife of Mr. Harry Allcock, M.I.E.E., of W. T. Glover & Co., Ltd.

Wills.—Mr. Sam Mavor, of Mavor & Coulson, Ltd., Glasgow, who left £26,920, stipulated in his will that, subject to certain annuities and the life rent of his sister, 58 per cent. of the residue of his estate should be applied as follows:—10 per cent. to the Royal Technical College, Glasgow, for bursaries and prizes to students; 10 per cent. each to the Glasgow School of Art and the Mining Institute of Scotland, for similar purposes; 8 per cent. to Glasgow Western Infirmary; and 20 per cent. to Mavor & Coulson, Ltd., for the benefit of widows and families of deceased employees of the company.

The late **Lord Meston,** former chairman of the Calcutta Electric Supply Corporation, and a director of the Galloway Water Power Co., the Urban Electric Supply Co. and other electrical concerns, left £66,244 (net personalty £54,854).

The late **Sir Robert S. Hilton,** O.B.E., chairman of the British Power & Light Corporation, Ltd., and formerly deputy-chairman and managing director of the Metropolitan-Vickers Electrical Co., Ltd., left £24,250 (net personalty £22,419).

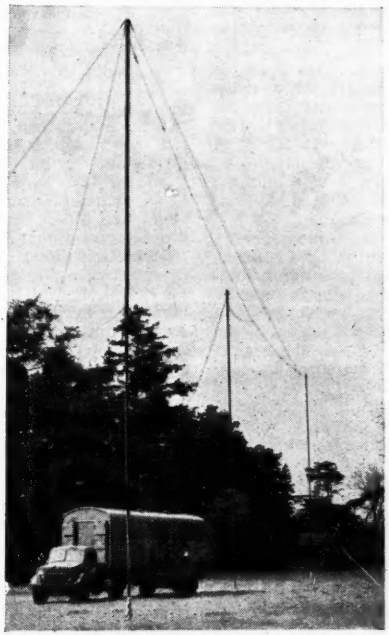
The "Golden Arrows"

Mobile Field Radio Equipment

WIRELESS communication is utilised by the British Army in many ways for a variety of purposes. The latest entirely mobile "stations" have been named "Golden Arrows"; each consists of a train of five vehicles forming a self-supporting section that can be driven anywhere and after three hours' assembly work, including the task of erecting the collapsible masts for supporting the aerials, can provide the equivalent of a small fixed commercial station of high power capable of high speed operation, which in the ordinary way would take many months to build.

The crew consists of one officer with 22 operators, instrument mechanics, electricians and drivers of the Royal Corps of Signals, and a cook of the Army Catering Corps who employs a portable petrol cooker.

Very few of the men on the job had any experience of radio before joining the Army and are being trained by the Royal Signals for this work in one-sixth of the time needed to become proficient in commercial service. Their trade category is the highest given in the Army.



Receiving vehicle with co-axial feeder and dipole aerials

The purpose of "Golden Arrows" is to provide main arteries of communication between armies in the field overseas and their G.H.Q. as well as with fixed stations in the United Kingdom. They will also despatch newspaper correspondents' traffic. Each is capable of transmitting and receiving 30,000 words a day, being virtually a mobile adaptation of a normal fixed radio-telegraph station arranged for automatic working. Most of the equipment is of standard type, the special feature being the compactness of lay-out for accommodation in such restricted space. When traffic exceeds that which can be sent by hand-keying in Morse at 20 or 30 words per minute automatic transmission is employed on a duplex basis, both transmission and reception taking place simultaneously on different frequencies. Consequently it is necessary to separate the transmitter and receiver physically in order to prevent the former from "blotting out" the weak signals received by the latter.

The receiving vehicle houses the automatic transmitting "head" and the automatic receiving equipment. The transmitter in another vehicle is driven to a site 400-800 yards away, and the signals from the transmitting "head" are sent as DC impulses over a cable pair to the transmitting vehicle where a relay controls the transmitter itself. A telephone is provided between the two vehicles so that instructions may be passed to the former when, for instance, it is necessary to change to another frequency. The remote-control and telephone cables are light field types carried on drums so that they may be unwound from a vehicle.

The power for the station is furnished by a Diesel 4-cylinder engine directly coupled to a 27-kVA generator giving a 400/230-V, three-phase, four-wire output; a mechanical governor and automatic regulator control the frequency and voltage to very fine limits.

The generating set is mounted as a trailer and is towed by a four-wheel-drive lorry which carries part of the crew and their kit when the station takes the road. A duplicate generating set is provided as a standby to the first, as power must be available for twenty-four hours a day, and a similar lorry is used to draw it. A four-core heavy cable is unrolled on site for interconnecting the

generators and the transmitting and receiving vehicles, the last-named being probably about 600 yards away from the others.

The transmitter itself is carried in a large semi-articulated vehicle and is of about 3-kW aerial rating; the spare coils are stored in a rack against the near-side wall. The anodes of the high-power valves are cooled by a blast of air from a blower. Facing the transmitter is the cubicle which contains the main transformers and mercury vapour rectifiers for supplying power to the transmitter, and the overload and time-delay relays which protect the transmitter from damage due to faults or incorrect operation. Behind the power supply cubicle there is a special resilient stowage for the carriage of spare power valves.

The aerial gear is all carried in or on the vehicle (the mast sections are slung below the trailer chassis) and when erected provides two dipoles on 70 ft. masts, one being used for the day (high) frequency, and the other for the night (lower) frequency.

The receiving aerials are similar to those for the transmitter, except that a co-axial feeder is employed between the "dipole" itself and the receiver. It was found necessary to fit interference suppressors to key contacts and motors in the vehicles in order to prevent the production of "man-made static."

Receiving Vehicle

The receiving vehicle is of similar shape, but contains a more complicated installation as it forms the traffic office in which the majority of the crew work. The forward end is divided off and contains air-conditioning equipment which supplies a current of cool dry air to the operating room through a duct slung below the ceiling. As the air intakes to this plant are covered with filters the interior of the vehicle is kept free of dust, sand and insects. In order to assist in keeping the vehicle interior cool, the "skin" of the vehicle and the floor are lagged with glass wool, all of which reduces the wear on the delicate instruments within. For cold climates a 3-kW heating element in the air intake replaces the cooling compressor.

The vehicle contains a long operating bench on the off-side, which carries two keyboard perforators, a receiving undulator, a Wheatstone transmitter hand key, and a spare undulator. The radio receivers themselves, which are high grade "communication" type instruments, are carried on resilient mountings on a shelf above the undulators, together with a "recording bridge" which converts the interrupted audio-frequency note from the receiver into DC to operate the undulator.

When a message is to be sent it is first handed to an operator who, by typing it out on the keyboard perforator, produces a paper tape bearing holes corresponding to the morse characters. This tape is then run through the Wheatstone transmitter which "keys" the radio transmitter automatically at speeds up to 150 words per minute. At the receiving terminal the signal is recorded by the undulator as a wavy line on a paper tape which is then drawn slowly across in front of a typewriter while a specially trained operator transcribes the message and types it out in its original form.

The typewriters and the "tape pulling" machines are installed at the front of the vehicle. In the near-side rear corner a small desk is provided for the superintendent and for a message clerk, who accepts and delivers messages through a small "letter box" in the side of the vehicle.

Production Team-Work

One of the most interesting things about this equipment is the fact that from the production point of view it represents "team-work" by British factories. Three firms share the building of the vehicles, while two others produce the fittings. The radio transmitter itself, the Wheatstone transmitter, the keyboard perforator, the masts, the aerial equipment, the typewriters, the telephones, the air conditioning equipment and even the mechanics' tool kit all come from different scattered factories to be assembled at a point near London and are taken over by the crews who will make the vehicles their homes and workshops overseas.

The earlier vehicles came straight off the production line to be shipped to theatres of war, in Sicily and Italy and Bengal, India.

Fatalities

Shock from "Portable Headlamp".—At an inquest at Quarrington Hill, Durham, on Lorna Thubron (37), a bus cleaner, it was stated that she was standing between two buses holding a "portable electric headlamp" when she screamed and fell to the ground. The floor was very wet. Another employee stated that the lamp had been used for eighteen months and shocks had been experienced once or twice before; she had reported the matter but it was not considered serious. A verdict of "Accidental death through being electrocuted while following her employment" was returned by the Coroner.

Ladder Touches H.V. Line.—At an inquest at Goole on James R. Clarkson (44), of Howden, it was found that death was due to a ladder which he was carrying coming in contact with a high-voltage overhead line 13 ft. above ground level at a substation. The ladder, which was 16 ft. long, was reinforced at each side with steel wire. On contact there was an explosion and Clarkson fell to the ground, the left side of his body being badly burned. A verdict of "Death by misadventure" was returned.

COMMERCE and INDUSTRY

Costing Clause in Contracts. New Manufacturers' Associations.

E.D.A. at Colchester

COLCHESTER was chosen for this year's annual dinner of the Eastern Section, South-East and East of England Area, of the British Electrical Development Association. Mr. P. E. Rycroft, borough electrical engineer of Great Yarmouth, presided and the guests were welcomed by the Mayor of Colchester (Mr. M. Pye) who recalled that as long ago as the reign of Queen Elizabeth one of the town's most honoured and famous citizens, Dr. William Gilberd, had been associated with electrical experiments.

Mr. F. A. Jacklin, vice-chairman of the Colchester Electricity Committee, who proposed the toast of "The Association," visualised the vast opportunities which the future would bring; for example, electrification of all railways and of all factories, which would indeed make England a pleasant place to live in.

Mr. C. Parker, vice-chairman of the E.D.A. National Council, responding, declared that the industry was ready to go ahead in the future and was well prepared to help those jobs that had to be done first. He thought that it would have to put its house in order and fresh legislation was necessary which, however, must not hamper the industry or stand in the way of progress. Better use must be made of the electrical skill that had galloped ahead far in advance of the industry.

Mr. V. W. Dale, assistant director and secretary, predicted that despite any opposition from politicians and others the industry would go from strength to strength.

Contracting Industry Wages

The National Joint Industrial Council for the Electrical Contracting Industry informs us that the following area has been raised from Grade "B2" to Grade "B" as from the second pay day in January, for the pay period covered by that pay day:—On the west at Far Forest following the Shropshire county boundary north to the Watling Street and then east along the Watling Street, including Cannock and Atherstone, to the Northamptonshire county boundary and on along the Warwickshire county boundary to the Daventry-Southam Road, and then a straight line to Astwood Bank on the Warwickshire-Worcestershire county boundary and from there a straight line to Far Forest and including Stourport.

Conditions of Contract

In a letter to members of the Electrical Contractors' Association, the Director (Mr. L. C. Penwill) says that the Federation of Associations of Specialists and Sub-Contractors, of which the Association is a member, view with alarm the fact that local authorities have apparently received some instruction from Government Departments to insist upon the insertion of the "costings" clause as a condition of contract for work within the purview of local authorities. Representations are being made in Government quarters, but, in the meantime, members are urged when receiving an inquiry which contains a costings clause from any county or local authority, to insist upon its deletion.

U.S. Radio Sets Nearly Ready

Tests of the first 10,000 radio receivers imported from the United States and the work of making them suitable for the British market will shortly be completed. They will be distributed to the trade within the next four weeks, according to a statement by the Radio Manufacturers' Association last week. A further 20,000 imported sets will become available, probably during the following three months. These sets, which are of many types, will be sold at controlled prices now being drafted by the Board of Trade. A quarter will be distributed through pre-war importers and the remainder through British set manufacturers. They will reach the public through normal radio trade channels. These sets will be followed by a number of civilian wartime receivers now being made to a standard design by the British radio manufacturers with Government approval. The prices of these sets, too, will be controlled.

Fan Makers' Association

At a meeting held in London in January, which was attended by representatives of twenty-nine firms engaged in the manufacture of fans, it was decided to form a Fan and Allied Manufacturers' Association. The main objects of the new body are to promote and protect the interests of British fan manufacturers, with due regard to the interests of the public, and provide Government and public bodies with facilities for conferring with and ascertaining the views of the fan industry; to assist the promotion of standardisation in the industry; formulate codes of practice and to encourage research; to establish and maintain fair and reasonable conditions of sale in the industry; and to promote, support or oppose legislation and other measures affecting the industry.

Membership of the Association is in no way limited as regards the size and range of products and is open to all bona fide British manufacturers of centrifugal, axial flow, propeller, desk and ceiling fans.

Mr. Geoffrey Woods (Woods of Colchester, Ltd.) was elected chairman and the following form the Council of the Association:—Messrs. E. G. Batt (General Electric Co., Ltd.), N. Gilbert (Berkeley & Young, Ltd.), E. Lacy-Hulbert (Aland Fan Co.), A. E. Lawrie (Arex Fans), T. P. Majer (Standard & Pochin Bros., Ltd.), and F. D. Moul (Air Control Installations, Ltd.).

Smoke Abatement

In the course of its report for 1943 the National Smoke Abatement Society says that the curtailment of its activities in the early days of the war has been followed by a steady re-development of activities as a result of the need to study the problem of reconstruction. Consequently

the Society has recently moved back to larger offices at Chandos House, Buckingham Gate, S.W.1. During the year the Executive Committee has recommenced its meetings which have been held in both Manchester and London. A small and informal panel of consultants has been set up to discuss and advise upon matters chiefly relating to the Society's reconstruction proposals.

Measuring Apparatus Association

Arising out of the Meters and Measuring Apparatus Export Group formed in 1940, a new Association has been constituted known as the British Industrial Measuring and Control Apparatus Manufacturers' Association under the chairmanship of Mr. W. G. Ardley, of George Kent, Ltd., with offices at 21, Tothill Street, London, S.W.1 (telephone: Whitehall 6711). The secretary is Mr. E. A. Nash. So long as the control of raw materials remains, the Export Group will continue to function.

Membership of the Association is confined to established British manufacturers and, it is stated, includes most of the well-known producers of fluid flow meters, industrial measuring instruments and automatic power and process control systems and equipment. The Association's objects are " to promote the welfare of the industry by the association of its members, and their agreement on matters of mutual concern in research, development and trading, while retaining all the benefits which accrue from competition within the industry."

American Appliance Prospects

A survey of the post-war market for domestic electrical appliances has been made by *Electrical Merchandising*. As a result of this it is estimated that there is an immediate need for at least 4,100,000 electric refrigerators and a market for a minimum of 3,750,000 in each of the first five post-war years. Already about 71 per cent. of wired homes have refrigerators. As regards electric washing machines, the immediate requirement is 2,500,000 and the potential sales 2,300,000 annually for the first five years after the war. The figures for ironers are put at 140,000 and 270,000 respectively. It is stated that 65·59 per cent. of American wired homes already have washing machines, but only 6·92 per cent. have ironers.

The present need for cookers (ranges) is put at 775,000 and the annual requirement for the first five years at 785,000. The " saturation " is said to be 12·74 per cent., which must be considerably lower than in this country.

Income Tax " Quiz "

The Metropolitan-Vickers Electrical Co., Ltd., is circulating among its employees a leaflet on the " pay as you earn " income tax system which takes the form of question and answer. It has been compiled from inquiries actually sent in from various quarters of the works.

Drawing Office Practice

A revised and considerably enlarged edition of B.S. 308 (Engineering Drawing Office Practice) has been published. The recommendations cover sizes and typical lay-outs of drawing sheets, scales, types of line, methods of projection, lettering, methods of indicating machining symbols, etc. A list of abbreviations s given and directions are included for the preparation of graphs. Appendices deal with the reproduction of drawings and contain references to British standards for material specifications, general engineering standards and the use of symbols on drawings. The revised edition, which is illustrated with 40 figures and diagrams and four folded plates, is obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 3s. 6d. post free.

Decimal Classification

An English edition of the " Universal Decimal Classification " is in preparation. Some parts of the first and second volumes are already obtainable and it is hoped that the electrical section will be published in the near future. Meanwhile, copies of preliminary drafts of a number of sections are available, including CG (DOM) 4882 Class 620 (testing of materials, power stations, economics of energy), price 1s.; CG (DOM) 4883 Class 621·1 (production, distribution and utilisation of steam), price 2s. 6d. ; and CG (DOM) 3091 Class 621·3 (electrical engineering) price 2s. 6d., which can be purchased from the British Standards Institution, 28, Victoria Street, London, S.W.1.

Combustion Engineering Course

A series of lectures, with discussion, arranged by the Fuel Efficiency Branch of the Ministry of Fuel and Power is being given at the Institution of Mechanical Engineers, London. On March 1st there was an attendance of approximately 100, and the discussion took the form of a " Brains Trust." The lectures are held from 6 to 8 p.m. on Wednesdays until April 12th, and the subjects include shell type and water tube boilers, space heating installations, coal distribution problems, etc.

Trade Announcement

Mr. J. A. Brook informs us that the electric lamp lock (" Lox-All " and " Rock ") part of the business of J. A. Brook, Ltd., Huddersfield, has been disposed of to Mr. Percy Phillipson, c/o Argosy Works, Kingston Road, Leatherhead, as from March 1st.

Calendar

Owing to the delay in issuing their 1944 calendar, Roper Bros., Ltd., have commenced the monthly sheets from March 1st, ending February 28th, 1945. A few copies of the calendar are available on application to the company at 5, South Anne Street, Dublin, C.2.

TRADE MARK APPLICATIONS

RECENT applications for British trade marks include the following, objections against which may be made within a month from March 8th :—

SPYROBOWL. No. 625,897. Class 7. Centrifugal pumps. Harland Engineering Co., Ltd., B.E.P. Works, Alloa, Scotland.

J. E. CONSTABLE (signature). No. 626,535. Class 11. Electric lamps and electric lighting fittings. John Edwin Constable, 24, Hook Rise, Tolworth, Surrey.

PARLIAMENTARY NEWS

By Our Special Reporter

The London J.E.A.

IN the House of Commons on March 7th, Sir Herbert Williams asked the Minister of Fuel and Power, what percentage of the electricity generated by electricity undertakings was generated by the London and Home Counties Joint Electricity Authority; and for what percentage of electricity sold the authority was responsible.

Major Lloyd George said the answer to the first part of the question was "Nil." He regretted that on grounds of security he could not answer the second part.

Sir H. Williams.—"Having regard to the relative unimportance of this body, will the Minister not take too much notice of its various publications?" There was no reply.

Rural Supply Costs

Brig.-Gen. Clifton Brown asked the Minister of Fuel and Power, whether, in view of the fact that electricity undertakings had a monopoly of erecting lines in their own districts, he would lay down an average standard price to be paid by owners who erected lines on their estimates in rural areas to supply their farms and cottages since in many cases electrical installation in country districts was being held up owing to the varied and excessive charges of local electricity undertakings.

Major Lloyd George said it was not possible to adopt this suggestion because the cost of extending supplies to consumers in rural areas varied considerably according to the amount of electricity required, the nature of the ground and so on. In any case, the Electricity (Supply) Acts gave him no authority to lay down an average standard price. This matter was an important part of the development of electricity supply in rural areas, which was receiving the active consideration of the Government.

Brig.-Gen. Clifton Brown urged the Minister to treat this matter as one of great urgency. Some cottages, he said, were now without light and without coal, and if the Government wanted to encourage agriculture those things must be provided.

Radio in Trains

Mr. Hutchinson asked the Parliamentary Secretary to the Ministry of War Transport whether he would consider the possibility of equipping long-distance trains with radio receiving sets so that drivers might be kept in touch with the controlling authorities in order to avoid the danger of failure to observe signals under conditions of fog such as those which caused the recent railway accident at Ilford.

Mr. Noel Baker said that although radio apparatus was being successfully used for certain purposes in railway operation, he was advised that, as at present developed, it would not afford a practicable remedy for failure to observe signals. Experiments in this form of communication between driver and guard or signalman were made some years before the war; but they were of a preliminary character, and in any case there were many special difficulties which resulted from war conditions. But he promised that the proposal would be borne in mind.

Railway Electrification

On March 8th Mr. Higgs asked the Parliamentary Secretary to the Ministry of War Transport what steps he was taking to extend the electrification of main line railways after the war.

Mr. Noel Baker said that the extension of electrification to the main line railways was a matter which the Minister would consider in relation to post-war development. It was, he understood, already under examination by the railway companies themselves.

Mr. Higgs asked the Minister if he was aware of the vast amount of replacement which would be necessary immediately after the war, and that an exceptional opportunity would arrive for electrification. Was he, furthermore, aware that coal consumption would be reduced by more than 50 per cent?

Mr. Noel Baker said he would not like to accept the last figure without examination, but a great deal of work had been done, and they were well aware of the opportunities.

Future of Distribution

On March 9th Mr. Mander asked the Minister of Fuel and Power when it was proposed to make a statement with regard to the Government's policy concerning the future of the distribution of electricity in this country.

Mr. Tom Smith, the Parliamentary Secretary to the Ministry, said that the future organisation of electricity distribution was receiving the active consideration of the Government, but the Minister was not yet in a position to make any statement.

Mr. Mander.—"Will the hon. member bear in mind that this is one of those instances where public ownership is better than private ownership, as indicated in the McGowan Report, and may we have an assurance that that Report and others will be carefully studied?"

Mr. Smith said he would bear those things in mind.

Sir Herbert Williams.—"Is the hon. member aware that the publicly-owned telephones expand at one-third the rate of the privately-owned electricity supply?" There was no reply.

Aviation Aids

A LECTURE entitled "Radio and Lighting in Commercial Aviation" was given by Mr. H. K. Bourne, M.Sc., A.M.I.E.E., of the B.T.H. Research Laboratory, to the Coventry Electric Club on March 7th. The meeting was well attended and the city's electrical engineer and manager, Mr. F. W. Godden, presided.

The author has made a study over a number of years of modern scientific aids to aviation, both in the United States and in Great Britain. In the course of this work he has flown over a number of U.S. airways by night and by day and has visited many airports.

The lecture, illustrated with lantern slides, described how modern aids have been applied to increase the safety of aviation.

Supervising Engineers

Association's Annual Luncheon

THE luncheon held last Saturday celebrated the thirtieth anniversary of the beginning of the Association of Supervising Electrical Engineers ; 375 members and guests were present, including the first President, Mr. A. H. Dykes, and Mr. A. Brammer, who has held the office of general secretary since 1921. The chair was taken by Mr. H. W. SWANN, now serving his fifth presidential term, who proposed the health of " Our Guests."

After mentioning that the cost of fires in this country, apart from those due to enemy action, amounted to £10 million per annum, he referred to the Codes of Practice (six of which were electrical) which Sir Hugh Beaver (Ministry of Works) had first announced at the Association's luncheon two years ago. Regarding suggestions that had been made that the life of an electrical installation need not exceed that of the building, if the latter were intended to last only a few years, he wondered how this could be done with safety.

Industrial Maintenance Well Performed

In responding, SIR CYRIL HURCOMB (Director-General, Ministry of War Transport and Chairman, Electricity Commission) stated that electrical maintenance in factories, so essential to the production of munitions, had been well performed in spite of the claims on the men for other national services. The grid, which some people had thought would be vulnerable in war, had proved its reliability ; its flexibility in enabling electrical demands to be met in out-of-the-way places had also been an important national asset. Electrical appliances had very considerably alleviated the position of people in the home.

Agriculture had greatly benefited from the boon of electricity and it was far from the truth that little had been done in meeting its needs. There were, of course, interstices to be filled in ; electrical appliances ought to be as common in rural as they were in urban areas. The setting up of the Hydro-Electric Board for the Highlands was to be welcomed, as was also the renewed study of the Severn Barrage scheme, on the advice of the Commissioners. Mr. S. B. Donkin, a member of the new expert committee, was a past-president of the Association. Another past-president, Mr. J. R. Beard, was taking a lead in the I.E.E. investigation of the scope for standardisation.

In proposing " The Electrical Industry," LORD FALMOUTH (President, Electrical Research Association) said that this industry, almost more than any other, was based on research, which would be essential to its post-war position here, especially in view of the importance attached to it in other countries. The universities formed the spearhead of research ; these were backed by the industrial laboratories, which had been responsible for most war developments. A third line was co-operative research in the British form, in which it was aided by public grants but was subject to no Government interference. No form of expenditure yielded better results. The quality of personnel must, however, be maintained. He urged users to adopt new ideas readily and thus encourage manufacturers to develop them.

COL. SIR A. STANLEY ANGWIN (President, I.E.E.), in reply, expressed his belief that British industry would stand a poor chance after the war without research. Mass production by itself would not be enough. He instanced the piezo-electric effects of quartz crystals, the potentialities of which had long remained dormant until it was discovered that they provided an ideal filter for providing 600 circuits from one pair of conductors for long-distance telephony. Although manufacturers' individual research activities had given excellent results, research in common was also essential. Some overlapping was not a bad thing, provided it did not trench upon the funds available.

" Keep Politics Out "

" The Association " was proposed by MR. E. E. HOADLEY (Chairman, British Electrical Development Association), who urged members to keep politics out of the Association as this, and not technical questions, was responsible for internal strife in the electricity supply industry. The E.D.A. had managed to do so ; its only purpose was to make the country more electrical. It was sometimes difficult to convince Ministries that there was more in electricity than providing light and radio, but women were demanding complete electrification of their homes.

Response was made by MR. W. H. BROOKS (Chairman, A.S.E.E.), who emphasised that, although it was essential for the post-war future that the finest engineers in the country should be attracted to installation and factory maintenance work, the conditions of service were not generally such as to encourage this. He said that the Association's apprenticeship scheme and the Swann Diploma were likely not only to promote higher standards of technical and practical ability, but also to enable employers to appreciate the responsible position of supervising electrical engineers.

ELECTRICITY SUPPLY

Post-War Policy Discussions. Manx Water Power.

Berwick. — STREET LIGHTING READY. —In response to an inquiry by the Town Council the Scottish Southern Electricity Supply Co., Ltd., has stated that full street lighting can be resumed in Berwick within 24 hours, on charges based on 1939 figures.

Birkenhead.—NOTHING FOR THE RATES.—It was announced at the Town Council meeting on Friday last week that this year the Electricity Department would not make any contribution to the rates.

Cardiff.—I.M.E.A. PROPOSAL UNTIMELY. — The Electricity Committee expresses the opinion that the time is not opportune to give effect to the recommendation of the I.M.E.A. in relation to the ownership of generating stations.

Cheltenham.—POST-WAR POLICY.—Various problems of post-war policy have been considered by the Electricity Committee which reports in favour of the adoption of a national form of tariff as an alternative to the statutory flat rate system of charging; the early standardisation of systems and voltages; co-operation between supply undertakings and manufacturers to secure adoption of standard designs of electrical apparatus with interchangeable parts; and a close study by the industry and other interested parties into the difficulties of complete rural electrification.

The Committee agrees to the principle of transferring the ownership of all generating stations to the Central Electricity Board and the adoption of a national form of bulk supply tariff applicable to all undertakings.

INSTALLATION PAYMENTS.—An inquiry has been received by the Electricity Committee from Electrical Facilities, Ltd., regarding the collection of outstanding payments due to the company from consumers for wiring installations. The company asked if assistance could be given in the collection of the money and maintenance of the slot coin devices, stating that it was willing to pay 20 per cent. of the total amount collected. The Committee has agreed to do so.

SUPPLY IMPROVEMENTS.—The Electricity Committee is to improve the supply in the Manchester Street area at a cost of £1,402 and extend the low-voltage network in the St. Paul's district at a cost of £534.

Douglas (Isle of Man).—WATER POWER.—At a recent meeting of the Corporation Electricity Committee the Isle of Man Electricity Board intimated that the Post-War Reconstruction Committee was considering the possibility of constructing hydro-electric stations on the island.

Glasgow.—PROPOSALS SUPPORTED.—The City Council, whose electricity is claimed to be the cheapest in Great Britain, at a special meeting on March 10th agreed unanimously to a resolution favouring the extension of public ownership of electricity undertakings in any post-war scheme for the organisation of supply. The decision was of the nature of an instruction to the local representatives who were to attend the conference of the I.M.E.A in London yesterday (Thursday). The resolution approved by the Council was that support be given to the proposals for the setting up of distribution areas and for the retention and extension of public ownership of electricity undertakings, for the generation of electricity under the Central Electricity Board, and for the introduction of a national standard bulk supply tariff subject to suitable protection for the owners of selected generating stations.

Keighley.—INDEPENDENT GENERATION TO CEASE.—In February the Council approved in principle the eventual closing down of the generating plant and authorised the borough electrical engineer (Mr. G. F. Moore), in collaboration with other officials and the chairman of the Electricity Committee, to continue negotiations with the Central Electricity Board. According to the *Keighley News*, the agreement, recently submitted to a special meeting of the Electricity Committee, provides that as from January 1st, 1946, or such earlier date as the Board may decide, the Council's generating station shall be permanently closed, and the Council shall have the right to dispose of such of the plant and buildings as it desires and retain the proceeds. Subject to the completion of the formal agreement the Board has agreed to remit the penalty of £5,180 incurred by the Council in respect of the abnormal demand taken last year through a breakdown of the local plant, and the Board will also take over the stocks of coal, amounting to 8,757 tons at January 1st, 1944, at the then book value of £13,458.

Lichfield.—CONTRIBUTION TO RATES.—The Electricity Committee recommends a contribution of £500 for rate relief.

SUPPLY TO SEWAGE WORKS.—The Electricity Committee has asked the electrical engineer to report on the possibility of affording an electricity supply to the sewage works and other properties at Curborough.

London.—MEMORANDA APPROVED.—Marylebone Council last week approved the proposals on electricity reorganisation contained in the memorandum prepared by the I.M.E.A. and the supply companies' associations. It has also approved those in the separate memorandum of the I.M.E.A., subject to suitable safeguards regarding the ownership of generating stations and, in connection with a national standard bulk supply tariff, provision for undertakings to retain the benefits of existing agreements should they so desire.

ELECTRIC PUMPING PLANT.—The Metropolitan Water Board has decided to replace the old steam plant at the Westerham works by an electrically driven borehole pump which can be purchased from the Runcorn R.D.C. for £1,000. The total cost of the proposal is £4,180 and the Board states that this partial electrification of the station will effect a saving in running costs of approximately £800 per annum while the saving in coal consumption would be about 200 tons per annum. For the supplies to the Sundridge and Knockholt areas an electrically

driven booster pump is to be installed at a total cost of £3,600.

Maidenhead.—RATE CONTRIBUTION. — The Electricity Committee has offered to contribute to the rates out of the past year's profit of the undertaking a sum equal to the product of a 1d. rate.

Sunderland. — I.M.E.A. RECOMMENDATION OPPOSED.—The proposal in the I.M.E.A. memorandum regarding the taking over of selected stations was discussed at a meeting of the Town Council. It was stated that if the recommendation were adopted it would cost Sunderland £5,000 to £6,000 in equalisation charges. The Council decided to oppose the plan.

Warrington. — RATE AID. — The Electricity Committee has agreed to contribute £10,000 in relief of rates.

Overseas

Canada.—ONTARIO RURAL PROJECT.—Mr. G. Challies, vice-chairman of the Ontario Hydro-Electric Commission, recently announced that the Ontario Government is to undertake a $6,000,000 programme of rural power extension this spring, mostly in Eastern Ontario and the Ottawa Valley. The programme provides for the construction of 300 miles of primary lines to serve 5,000 new customers in the eastern farm districts.

Eire. — ELECTRICITY FROM TIDES. — In an address delivered before the Institution of Civil Engineers of Ireland, Mr. de Valera referred to the use of the tides as a source of electric power. As a result of these observations Deputy P. J. Fogarty has just asked in the Dail whether the Minister of Industry and Commerce would be disposed to reconsider the report on this subject received by his Department in September, 1942. Mr. Sean Lemass replied that the report submitted to his Department concerning the use of tidal power for the generation of electricity had been carefully examined by the Electricity Supply Board. The Board had advised him that the scheme would be " technically feasible," but the capital cost would be so high that this means of generation would be uneconomic.

RADIO & TELEPHONY

Corsica.—NEW TRANSMITTER.—A new broadcasting station, Radio Corsica, built since the liberation of the island, has been inaugurated by Radio France. It transmits on 353 metres and on short waves in the 29 metre band.

Great Britain.—TRUNK PHONE CALLS.—For the first time the number of daytime trunk telephone calls has exceeded 1,000,000 in a week.

BROADCASTING STATION'S " COMING OF AGE." —Mr. R. W. Foot, Director-General of the B.B.C., last week attended a reception held at Broadcasting House, Glasgow, to mark the twenty-first anniversary of the Glasgow station. Mr. Foot joined with the Lord Provost of Glasgow, Mr. James Welsh, in offering congratulations to the staff and paid tribute to the early promoters of broadcasting in Glasgow. Professor J. D. Mackie, Glasgow University, thanked the two speakers. Mr. Melville Dinwiddie, Scottish Regional Director of the B.B.C. presided.

TRANSPORT

Bradford.—PURCHASE OF TROLLEY-BUSES.—The Corporation Transport Committee has authorised the purchase of a further twelve trolley-buses.

Gateshead.—TROLLEY-BUSES. — The Town Council, in conjunction with Newcastle-on-Tyne City Council, has approached the L.N.E.R. with regard to the raising of the West Street railway bridge to allow double-decker trolley-buses to pass under it.

Sunderland.—TRAMWAY PROPOSAL VETOED.—The Ministry of War Transport has disapproved the Town Council's plan for duplicating the tram track in part of Durham Road.

South Africa.—TROLLEY-BUSES FOR DURBAN. —The *South African Engineer and Electrical Review* reports that after protracted discussion Durban City Council has decided to call for tenders for fifty-two double-deck, three-axle trolley-buses (estimated to cost £202,800) for post-war delivery.

Scottish Railway Control

A MODERN control system, covering the principal lines of the former Great North of Scotland Railway, has recently been installed by the L.N.E.R. A network of up-to-date telephone circuits, similar to those in use on other parts of the L.N.E.R. system, now serves an area in which hitherto all communication with outlying stations and signal boxes had been by means of single needle telegraph. There are two types of circuits connected to the control, namely, code ringing for inter-communication between the various signal boxes, etc., and selective ringing for conversations between the controllers and the various stations on the circuit. The noise of bells ringing being very undesirable in a control office, the glowing of a white lamp is used to indicate an incoming call on the controller's panels. Green light indications show when the line is engaged by another person at the control.

Each of the two controllers has in front of him a diagram of the area under his control, a telephone key board containing the lamp indicators mentioned above, switching keys, ringing buttons and a dial for ringing stations on the selective circuits. There is also a graph on which the running of trains is recorded, and which enables the controller to see at a glance the position of every train in the section of line which comes under his jurisdiction. There are three omnibus circuits covering the principal main line in the area, but relay switching units at two intermediate stations remotely controlled by the operation of the " coupling " key at the control permit switching in tandem so that the controller can ring and speak to any station on this length of line.

The telephone control apparatus was supplied by the General Electric Co., Ltd., and the work was carried out by Mr. W. Y. Sandeman, engineer, Edinburgh, under the direction of Mr. J. C. L. Train, chief engineer, to meet the requirements of Mr. R. Gardiner, superintendent, Scottish Area.

Installation Maintenance

Reduction by Improved Design

OPENING the discussion on Mr. H. Drake's paper at the Institution of Electrical Engineers on March 9th, (*Electrical Review*, March 10th, p. 333), on how installation equipment should be designed to facilitate maintenance, Mr. FORBES JACKSON (L.C.C.) remarked that that the manufacturer received very many requests for "specials." He had found it very difficult to persuade any manufacturer at any time that his article was not perfect and manufacturers were not very responsive to comment from the user. He did not think the B.S.I. had the knowledge to deal with many of the matters discussed in the paper and he doubted whether there was any possibility of a National Proving House. Sometimes he wondered whether the Electrical Contractors' Association was not in the best position to deal with the problem by compiling a list of approved materials.

Grip Joint Conduit

He recommended contractors who wanted to get into the small class of housing installation work to study the merits of grip joint conduit with brazed or welded tube. With this it was possible to cut the cost by 20 per cent. and make a perfectly satisfactory job. Provided an installation was done under proper conditions there was not likely to be much trouble whatever system of wiring was employed ; most trouble was caused by accessories. Maintenance was largely a matter of changing a switch or a socket and the cost of sending a man to do that was usually very much greater than the cost of the material used. Therefore, the aim should be to make the fixed part of the installation as simple as possible and use flexible for plugging in, thus enabling the consumer to take out any faulty accessory and send it to be repaired.

MR. H. J. CASH expressed a strong preference for copper conduit and said he believed that but for the war they would, by now, have had considerable experience of it. Before the last war he had considerable experience of tinned brass tube with a thin wall having high heat conductivity ; the temperature inside and outside the tube was always practically identical. Condensation was unknown. He had inspected some of these tubes which were 35 years old and they appeared to be good enough for another 35 or 50 years. There was practically no deterioration of the rubber and no other system which had ever been adopted had approached it for freedom from maintenance. He disagreed with the suggestion that tough rubber installations needed mechanical protection, unless the author meant having a tube in plaster through which to run the wires.

Supporting the author's views upon the need for a deeper box to take the slack and prevent the conductor being pinched between the unit and the back of the box, he hoped the B.E.A.M.A. would take note of this in order to prevent unnecessary maintenance. If there was a sufficient demand for insulated lamp caps, the manufacturers would produce them. Speaking with regard to earthing, he said it was unfair to ask the consumer to pay so much extra for his installation on the ground that he was being given safety when, in fact, he was not. Now that plastics had made such great strides, we should concentrate on the all-insulated system.

MR. J. B. TUCKER discussed tumbler switches, plugs, sockets and lampholders, and remarked that a large degree of unofficial standardisation already existed in the case of tumbler switches. He expressed regret that the question of flat-pin plugs had been raised in the paper and said that their use or otherwise depended on what a particular country started with. He did not think there was any need for standardisation of interlocking mechanism as there were several makes of switch sockets which would interlock. It should not be imagined that it was desirable to introduce standards for all accessories and he felt it wiser to deal with certain features by unofficial agreement.

He wished users would make themselves more familiar with the main clauses of relevant B.S. documents. In too many cases they accepted accessories which did not comply with the Standard Specification and then blamed the Specification if the apparatus was not satisfactory.

Cable Core Identification

MR. S. W. MELSOM said with regard to standardisation of the colours of cable cores, that there was a scheme in a Standard Specification for many years, but a large number of people were already committed to a colour scheme and could not change over because of the cost. Therefore, there were some thirty ranges of colours for cables.

He, too, disagreed with the author's suggestion of giving mechanical protection to tough rubber cables, but agreed that some boxes were not large enough for the cables and there should be co-operation to get the terminal points satisfactory. The Electrical Contractors' Association should convene a conference and take charge rather than let the manufacturers do it. He was very

strongly of the all-insulated school. Iron pipes were only used for carrying cables because they were used for carrying gas, and that complex must be avoided.

MR. F. C. FUKE expressed the view that lowering gear for each switch tank would be too expensive and said there should be portable lifting gear, which could be used for several tanks. The lack of space in many boxes was due to the too common tendency to buy the cheapest article, the only remedy was for the B.S.I. to issue a specification stipulating the minimum radius of bends for different sizes of cable. He spoke of difficulties he had experienced with the use of mineral-insulated wiring systems and expressed the hope that the day was not far distant when there would be available a sufficient range of cartridge fuses to take the place of porcelain fuses.

He did not think that interlocking was really necessary on AC circuits and disagreed as to the use of flat-pin plugs which he contended gave more trouble than the round-pin type. Finally, he showed an illustration of a plug which he said was so designed that the disadvantage of lack of flexibility in the saw-cut type of pin was overcome and the two halves of the pin always sprang back to their original position and could not break.

MR. J. I. BERNARD (E.D.A.) remarked that some years ago the copper concentric earth return system was one of the most satisfactory that could be used. Perhaps the scope for it to-day was greater than used to be the case because there was not now the objection to earthing there used to be on account of interference with Post Office communications, etc. The ordinary industrial motor had proved itself to be suitable for farm work.

MR. W. H. BROOKS suggested that the B.S.S. marking on accessories should be underlined and that a great deal of difficulty would be avoided if it were made illegal to sell apparatus which was not made to the approved standard.

Farm Motors

MR. F. E. ROWLAND contended that the ordinary protected type of motor was largely used on farms and gave very good service, but he felt that the cowl-cooled motor was the ideal one for farm work. There was no need for a special motor for farm work ; there were already many suitable designs available. Farm installations should be of such a character that the parts of the byre to which cows had access could not possibly become alive. In fourteen years' experience in the agricultural field he remembered only one serious accident to cows in this country and that was due to carelessness in installation.

MR. F. H. MANN referred to the need for the shutter mechanism of switchgear to be designed in direct relation to the switch position. A number of serious accidents had occurred due to men having access to live contacts possibly because of the failure of, or inadequate marking of, the shutter mechanism. He also mentioned difficulty in identifying live and dead contacts in certain cases. With regard to flat back switchboards, the practice of including in some air break switches an overload coil in the live connection was a trap for the unwary. At least one manufacturer had now eliminated that feature.

Duct Systems

MR. P. S. CATTLE dealt with a large number of the items listed in the paper and made many practical suggestions for dealing with criticisms made in the paper and difficulties which he himself had found in installation work over a period of many years. He emphasised the need, generally, for designing with a view to easy maintenance and agreed that copper conduit made a first-class job, but added that duct systems were very suitable for certain classes of work. That type of installation would meet 90 per cent. of requirements if there were co-operation between the architect, the constructors and the installation engineer before a building went up. The present bakelite lampholder called for improvement and he concluded by referring to the value to export trade after the war of a reduction of sizes and types of fittings and apparatus.

MR. R. MARRYAT discussed the industrial side and urged the need for adequate means of access to all parts of an installation. He suggested that all controls should be fitted with interlocked isolating switches and that wire-glass inspection panels should be provided to enable the maintenance engineer to watch the operation of the control through the panel.

The author in the course of his reply said that in view of what Mr. Forbes Jackson had said with regard to grip conduit, he would have to look into that matter again. As to copper conduit, he himself had used quite a lot of it with great satisfaction and its cost was not very much greater than that of screwed conduit. He also agreed with the use of the all-insulated system.

There was chaos in cable marking and, while he was not blaming anybody, he hoped that standardisation would get over that problem. With regard to tank lowering gear he did not care for the idea of portable gear ; he wanted smaller sizes of gear than were available at present. The paper was not intended to criticise anybody in any way, but only to point out that more attention might be paid to the maintenance side and that the contractors and consulting engineers were the people who should come forward with first-hand information.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Electrical Distribution of Yorkshire, Ltd.—The speech to be made at the annual meeting on March 20th by the chairman (Mr. R. W. Wickham) has been circulated with the report. In it Mr. Wickham says that during the year the company concluded negotiations for the purchase of a small non-statutory undertaking in its area and thus made a still further contribution to the unification of electricity supply. In general supplies cannot be given so advantageously by small undertakings as by concerns such as theirs able to call upon the services of highly-skilled technicians in all the different branches.

Referring to the company's subsidiaries, he says that, generally speaking, rural communities will have to turn to so-called private enterprise for a supply of electricity. In Cumberland they had a good example of what could be done. In reorganising electricity supply, recommendations influenced more by political than practical considerations should be eliminated and changes should only be made if they are certain to benefit the ultimate consumer.

The British Thomson-Houston Co., Ltd., reports that profits for 1943, after providing for taxation, amounted to £580,362, compared with £562,883 for the previous year. Depreciation requires £226,435 (£224,950) and an increased amount (£150,000 against £100,000 last year) is added to general reserve. The ordinary dividend remains at 7 per cent. and £248,368 is carried forward, compared with £254,171 brought in.

R. B. Pullin & Co., Ltd.—Speaking at the annual meeting last week, the chairman (Mr. R. B. Pullin) said that it had been necessary with the expanding business, to increase the bank overdraft to an amount exceeding the company's nominal share capital. The shareholders would be asked to authorise an increase in the borrowing powers to an amount not exceeding twice the nominal share capital. All the company's subsidiaries had made a substantial profit during the year. Their balances after meeting taxation had been carried forward.

The Lancashire United Transport & Power Co. has declared a final ordinary dividend of 6 per cent., making 10 per cent. for the year (same). The profit, before providing for taxation, debenture interest, etc., was £185,867 (against £210,510).

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., announces first and final dividends of 9 per cent. on the ordinary shares and 8 per cent. on the preferred ordinary shares, both the same as last year.

Taylor, Tunnicliff (Electrical Industries), Ltd., has reduced its final dividend from 12½ to 7½ per cent., making 10 per cent. for the year (against 15 per cent.).

Ericsson Telephones, Ltd., are again paying a final dividend of 12 per cent., with a bonus of 3 per cent., making 20 per cent. for the year, all free of tax.

International Combustion, Ltd., has declared a final ordinary dividend of 15 per cent. and a bonus of 10 per cent., maintaining the distribution for the year at 30 per cent.

The profit for the past year was £216,249 (against £226,553). The special provision for undue wear and tear of plant is again £20,000.

The Clyde Valley Electrical Power Co. recommends the payment of a final dividend of 5 per cent. on the ordinary stock, maintaining the total distribution for the year at 8 per cent.

The North-Eastern Electric Supply Co., Ltd., announces the payment of a dividend of 4½ per cent. on the ordinary stock, making 7 per cent. for the year (same).

The Metropolitan Electric Supply Co., Ltd., is maintaining its dividend at 8 per cent. for the past year by a final distribution of 5 per cent.

Associated Electrical Industries, Ltd., is paying an unaltered ordinary dividend of 10 per cent. for 1943.

Heenan & Froude, Ltd., are again paying an interim dividend of 5 per cent.

New Companies

Harvey Briggs (Refrigeration), Ltd.—Private company. Registered February 29th. Capital, £5,000. Objects: To carry on the business of manufacturers of, and dealers in, refrigeration apparatus, cold storage and ice stores, electrical, gas and general engineers, etc. Directors: Sir Robert G. A. Staples, Bt., Barkfield, Freshfield Road, Formby, Lancs; G. N. Milton, Maple Lodge, Littleton, Chester; A. N. Allan, 67, Greenhill Road, Moseley, Birmingham; and W. Beer, Springfield, Blue Lake Road, Knowle, Warwicks. Registered office: 12, Millgate, Stockport.

Medley's (West Bromwich), Ltd.—Private company. Registered March 4th. Capital, £2,000. Objects: To carry on the business of electricians, electrical, radio, mechanical and general engineers, manufacturers of, and dealers in, photographic and cinematographic equipment, gramophones, dictaphones and typewriters, etc. Directors: A. Medley and Jessie M. Medley, both of 69, Dudley Street, West Bromwich. Registered office: 25, Spon Lane, West Bromwich, Staffs.

Transalt, Ltd.—Private company. Registered March 3rd. Capital, £5,000. Objects: To carry on the business of designers and manufacturers of refrigerating equipment, insulated and other carriages, rolling stock and vehicles, commercial, industrial and household freezing and preserving plant, etc. Subscribers: A. H. A. Winfield and E. J. French, both of 2, Field Court, Gray's Inn, W.C.1. Solicitors: Hugh V. Harraway & Sons, W.C.1.

Tanjon (Newcastle), Ltd.—Private company. Registered March 3rd. Capital, £1,000. Objects: To carry on the business of marine and general electrical engineers and contractors,

etc. Directors: J. J. Tanner, 186, Hampton Road, Twickenham, Middlesex; R. W. Reynolds, 5, Savile Close, New Malden, Surrey; and R. E. W. King, 6, Southway, Carshalton Beeches, Surrey (all directors of Johnson & Tanner, Ltd.). Registered office: Exchange Buildings, Queen Street, Newcastle-on-Tyne.

Nurange Products, Ltd.—Private company. Registered March 3rd. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, gas and electric cookers, stoves, ranges, boilers, ovens, fires, radiators and lamps, gas, electrical and oil appliances, kitchen equipment, etc. Subscribers: H. C. Cousins, 139, Welford Road, Shirley, Warwickshire and A. J. Corbett, 25, Oakfield Road, Selly Park, Birmingham, 29. Solicitors: Pinsent & Co., Birmingham.

Stage Electrical Equipment, Ltd.—Private company. Registered March 6th. Capital, £4,000. Objects: To carry on the business of electrical, mechanical and general engineers, etc. Subscribers: H. W. Weil, Essex House, Essex Street, W.C.2, and Eileen Greenwood, 47, Aspinden Road, S.E.16. The directors are H. J. Turner and E. M. Corvaja. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

Circuit Electrical Co., Ltd.—Private company. Registered March 7th. Capital, £500. Objects: To carry on the business of electricians, mechanical, electrical, motor and general engineers, etc. Subscribers: S. B. Miller, 38, Seymour Court, N.W.2, and P. Pilgrim, 16, Seymour Court, Coles Green Road, N.W.2. Solicitors: Wingfields & Co., 203, High Road, Kilburn.

R. C. Wallis, Ltd.—Private company. Registered March 8th. Capital, £500. Objects: To acquire the business of a radio and electrical engineer, contractor and dealer carried on by R. C. Wallis at 210, Field End Road, Eastcote, Middlesex. First directors: R. C. Wallis and Mildred I. Wallis, both of 82, Elm Avenue, Eastcote. Registered office: 210, Field End Road, Eastcote.

Companies' Returns

Statements of Capital

Credenda Conduits, Co., Ltd.—Capital, £50,500 in £1 shares (all ordinary). Return dated November 15th. All shares taken up. £30,500 paid. £20,000 considered as paid. Mortgages and charges: Nil.

Shirebrook Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 16th. 4,800 shares taken up. £4,162 10s. paid, being £1 per share on 2,800 and 15s. per share on 2,000. £137 10s. remains unpaid. Mortgages and charges: Nil.

Hailwood & Ackroyd, Ltd.—Capital, £25,000 in £5 shares (3,200 preference and 1,800 deferred). Return dated November 8th. All shares taken up. £15,500 paid. £9,500 considered as paid. Mortgages and charges: Nil.

Associated Distributors, Ltd.—Capital, £80,000 in 50,000 10 per cent. cumulative preference shares of £1 each and 120,000 ordinary shares of 5s. each. Return dated November 20th. 35,805 preference and 6,000 ordinary shares taken up. £37,305 paid. Mortgages and charges: Nil.

Armand Taylor & Co., Ltd.—Capital, £2,000 in £1 shares (100 preference and 1,900 ordinary). Return dated July 23rd (filed December 2nd). 60 preference and 585 ordinary shares taken up. £45 paid. £600 considered as paid. Mortgages and charges: Nil.

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 3,000 preference and 7,000 ordinary shares of £1. Return dated December 1st. 2,306 preference and 4,266 ordinary shares taken up. £4,560 paid. £2,012 considered as paid. Mortgages and charges: £14,000.

Increases of Capital

Tucker Installations, Ltd.—The nominal capital has been increased by the addition of £4,800, in £1 shares, beyond the registered capital of £200.

Elliston, Evans & Jackson, Ltd.—The nominal capital has been increased by the addition of £5,000 in £1 preference shares of £1 each beyond the registered capital of £5,000.

Mortgages and Charges

Sayers & Sons (Brighton), Ltd.—Charge on 10, Vine Street, Brighton, dated April 20th, 1942, to secure £300. Holder: Mrs. A. E. Smith, 39, Kensington Gardens, Brighton. (Registered February 19th, 1944, by permission of the Court.)

Metropolitan Relays, Ltd.—Satisfaction in full on January 19th, 1944, of debenture dated July 20th, 1936, and registered August 5th, 1936, securing £750.

Televoice, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated February 8th, 1944, to secure £150. Holder: W. D. Bradley, Sutton Coldfield.

Park Bros., Ltd.—Satisfaction in full on February 12th, 1944, of mortgage dated June 5th, 1934, and registered June 9th, 1934, securing £650.

Aabacas Engineering Co., Ltd.—Assignment on February 23rd, 1944, of proceeds of contracts, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Receivers Released

Accumulators "Elite," Ltd.—E. Sproat of Union Chambers, 45/47, Commercial Street, Halifax, ceased to act as receiver or manager on December 28th, 1943. (Notice filed February 25th, 1944.)

G. H. Gibson, Ltd.—O. C. James, of Arcade Chambers, Caerphilly, ceased to act as receiver on January 22nd, 1944. (Notice filed February 28th, 1944.)

Liquidations

Insulande, Ltd., Hammans Industries Ltd. and Hamofil Manufacturing Co., Ltd.—Winding-up voluntarily. Liquidator, Mr. C. H. Barclay, 103, Cannon Street, London, E.C.4.

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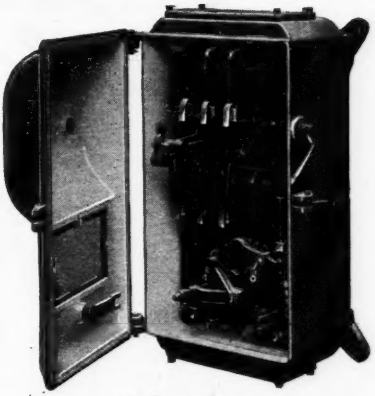

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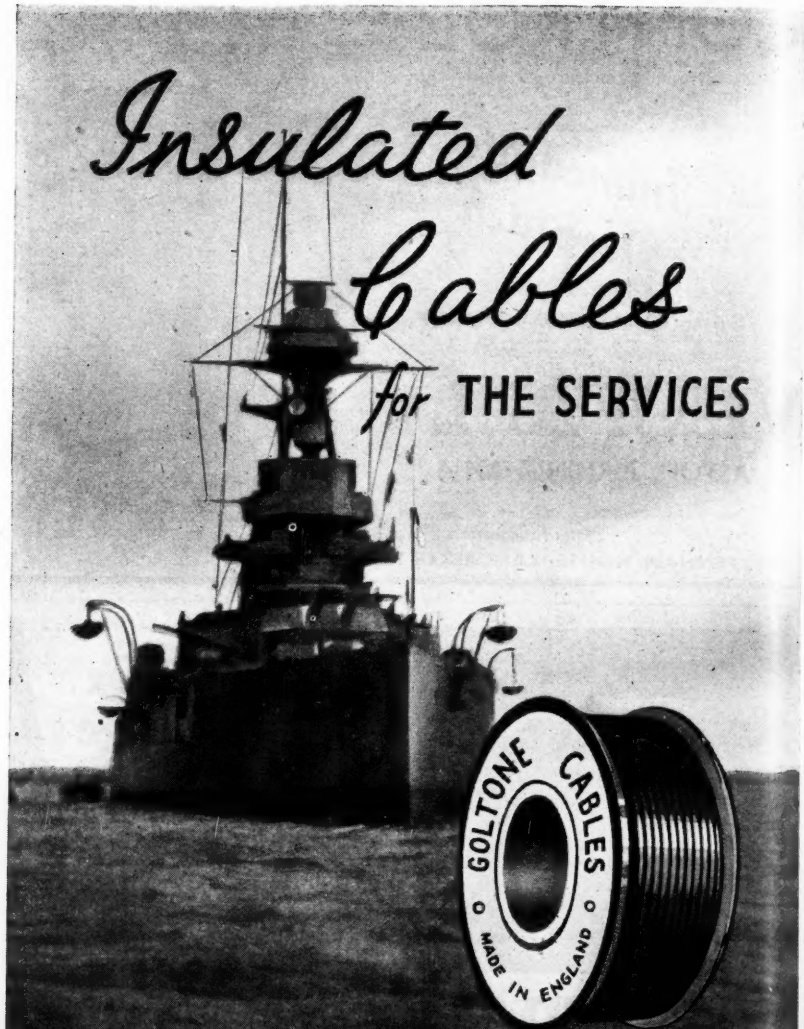
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STOCKS AND SHARES

TUESDAY EVENING.

THE course of Stock Exchange markets and of business continues to be largely governed by war conditions. People's attention is so much focused upon war developments and, also, upon the forthcoming campaign for fresh war loan subscriptions, that they have little time or inclination to devote to stocks and shares. Prices are maintained in practically every market where channels can be found for the employment of the considerable sums still on the lookout for good security and a reasonable rate of interest. The unhappy coal strike has had a mildly depressing effect upon prices of companies engaged in the industry. The spasm of firmness which lifted the prices of Home Railway stocks has subsided, and quotations tended to sag in the absence of fresh support.

Equipment and Manufacturing

Holders of shares in electrical equipment and manufacturing companies may be assured of their undertakings being fully supplied with work for many years to come. The prices of the ordinary shares in such companies as, for instance, British Insulated, Callender's and Henley's, have reached a level at which the yield on the money on the present-paid dividends is gilt-edged, but this range of levels may be deemed by the investor to be justified.

There can be few sounder investments at the present time to be found in the Stock Exchange markets than those of the companies in the class upon which will fall the duty, amongst many other calls, of providing electrical equipment, etc., for the extension of electrification, after the war, by the Home Railway companies. Callender's have recovered to 102s. Johnson & Phillips are 1s. 6d. up at 72s. Ericsson Telephones, at 52s. 9d., have held their last week's gain.

That Railway Agreement

Controversy persists in making itself heard around the vexed question concerning the Government's bargain with the Home Railway companies, and the amount guaranteed to the companies under the agreement which the critics seek to have revised. At the Great Western's recent meeting the chairman gave his own personal view as being that any present approach to the Government, for revision of the agreement, would be premature and contrary to the spirit in which it was accepted. London Passenger Transport "C" stock has been in some demand. Stock changed hands up to 67, the purchasers being encouraged by the Board's post-war prospects. The net revenue for the year 1943 shows an unimportant decline: the dividend on the "C" stock is 5s. per cent. up, as already notified, at 3¼ per cent.

Associated and B.T.H.

Associated Electrical Industries has done well in the year recently ended and is again to pay 10 per cent. dividend, the same as that which has been distributed every year since 1936. The company controls the British Thomson-Houston Co. which has also published its accounts, showing a profit of £580,000, an increase of £17,500 for the year. The B.T.H. Co. has declared a dividend of 7 per cent. on its 2,000,000 ordinary shares, all of which are held by Associated Electrical Industries. The latter company's 7 per cent. preference stand at 35s. 9d. at which the return on the money is £3 18s. 6d. per cent. A.E.I. ordinary have hardened to 52s. 6d. at which the yield is £3 16s. per cent.

Allen West

Allen West 5s. shares have recently come into favour, less because there is any particular hope of the dividend being raised from its present 7½ per cent., than from the yield of £5 3s. 5d. per cent. which, at 7s. 3d., the shares offer. This is a reasonable return to expect from the ordinary shares of any well-known company, and Allen West paid annual dividends of 7½ per cent. for six consecutive years. In 1939, the company distributed a bonus of 2½ per cent. in addition. Earnings have been consistently steady round about 13 per cent. upon the ordinary shares. Three or four years ago, Allen Wests fell to 3s. in spite of the 7½ per cent. dividend, but the shares recovered upon consideration of the useful yield which they offer, as well as the fact that the company's balance-sheet is a good one.

High-Priced Shares

Consolidated Signal shares have recovered the dividend and are still quoted at 6. The company's income arises almost entirely from its interest in the Westinghouse Brake & Signal Co., and the holding in the latter remains at £364,743. International Combustion shares are unchanged at 6¼ upon announcement that the dividend is again to be 30 per cent. for the year, making the fourth consecutive year for which this rate has been distributed. Amongst other high-priced shares, De la Rue rose to 8½ before going back to 8 on a little profit-taking.

Price Fluctuations

Ensign Lamps moved up to 22s. 6d. on the offer made by E. K. Cole to its shareholders. "Ekco" shares are 1s. higher at 26s. "E.M.I." have again revolved closely

(*Continued on page* 393)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Mar. 14	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	63/-	..	3 19 4
British Power and Light	6	7	32/6	..	4 6 2
City of London	7	5½	27/-	+6d.	4 1 6
Clyde Valley	8	8	42/-	..	3 16 0
County of London	8	8	40/-xd	..	4 0 0
Edmundsons:					
7% Pref.	7	7	34/6	..	4 1 4
Ord.	6	6	29/-	..	4 2 9
Elec.Dis.Yorkshire	9	9	45/-	..	4 0 0
Elec. Fin. and Securities	12½	12½	55/-	..	4 11 0
Elec. Supply Corporation	10	10	47/-	..	4 5 0
Isle of Thanet	Nil	Nil	18/-	..	—
Lancs. Light and Power	7½	7½	37/-	..	4 1 1
Llanelly Elec.	6	6	25/-	+6d.	4 16 0
Lond.Assoc.Electric	4	3	23/-	..	2 12 2
London Electric	6	6	28/-	..	4 5 9
LondonPowerRed. Deb.	5	5	103½	..	4 14 7
Metropolitan E.S.	8	8	40/-xd	..	4 0 0
Midland Counties	8	8	40/6	..	3 19 0
Mid. Elec. Power	9	9	45/-	−6d.	4 0 0
Newcastle Elec.	7	7	31/6	..	4 9 0
North Eastern Elec.:					
Ordinary	7	7	34/-	..	4 2 4
7% Pref.	7	7	35/-	..	4 0 0
Northampton	10	10	48/-	..	4 3 4
Notting Hill 6% Pref. (£10)	6	Nil	11	..	—
Northmet Power:					
Ordinary	7	7	38/-xd	..	3 13 9
6% Pref.	6	6	30/6	..	3 18 8
Richmond Elec.	6	6	26/-	..	4 12 4
Scottish Power	8	8	40/6	..	3 19 0
Southern Areas	5	5	23/-	..	4 7 0
South London	7	7	27/-xd	+9d.	5 3 8
West Devon	5	5	23/6	..	4 5 0
West Glos.	4½	3½	24/-	..	2 18 4
Yorkshire Elec.	8	8	43/-	..	3 14 5
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	6/3	+3d.	—
Calcutta Elec.	7*	6*	36/-	−1/-	3 6 8
Cawnpore Elec.	10	10	35/-	..	5 14 3
East African Power	7	7	33/-	..	4 4 10
Jerusalem Elec.	7	5	28/6	..	3 10 2
Kalgoorlie (10/-)	5	5	10/-	..	5 0 0
Madras Elec.	4*	Nil	23/6	..	—
Montreal Power	1½	1½	23½	..	6 7 8
Palestine Elec."A"	4*	5*	40/-	..	2 10 0
Perak Hydro-elec.	6	7	10/-	..	—
Shawinigan Power	83cts.	90cts.	17	+½	—
Tokyo Elec. 6%	6	6	18	..	—
VictoriaFallsPower	15	15	4⅛	..	3 9 7
Whitehall Inv.Pref.	—	6	24/-	..	5 0 0

Company	Dividend Previous	Dividend Last	Middle Price Mar. 14	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence)	—	2	100	..	3 0 0
1955–75	5	5	114	..	4 7 9
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	104	..	3 7 4
1974–94	3½	3½	101	..	3 4 6
London Elec. Trans. Ltd.	2½	2½	97	..	2 11 3
London & Home Counties1955–75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.:					
A	4½	4½	123½	..	3 13 0
B	5	5	121½	..	4 2 4
C	3	3½	66	..	4 18 6
WestMidlandsJ.E.A. 1948–68	5	5	108½	..	4 12 1
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	118	..	5 1 8
Def.	1½	1½	29	+1	5 3 5
Anglo-Portuguese	8	8	24/-	−6d.	6 13 4
Cable & Wireless:					
5½ Pref.	5½	5½	115	..	4 15 6
Ord.	4	4	81	+½	4 18 9
CanadianMarconi	$1	Nil	4cts.	9/9	+9d. —
Globe Tel. & Tel.:					
Ord.	8½*	5*	37/6	+6d.	2 13 4
Pref.	6	6	30/-	..	4 0 0
Great Northern Tel. (£10)	Nil	Nil	20½	..	—
Inter. Tel. & Tel.	Nil	Nil	15½	+½	—
Marconi-Marine	7½	7½	33/-	..	4 11 0
Oriental Tel. Ord.	16	10	44/-	..	—
Telephone Props.	6	Nil	16/-	..	—
Tele.Rentals(5/-)	10	10	11/6	..	4 7 0
Traction and Transport					
Anglo-Arg.Trans.:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc.	Nil	Nil	7	..	—
Brit.Elec.Traction:					
Def. Ord.	45	45	1115	..	4 0 7
Pref. Ord.	8	8	175	..	4 11 5
Bristol Trams	10	10	54/-	..	3 14 2
Brazil Traction	$1	$1¼	26½	+½	6 17 6
Calcutta Trams	5½	6½	39/-	..	3 6 8
Cape Elec. Trams	5	6	26/-	..	4 12 4
Lancs. Transport	10	10	45/6	..	4 8 0
Mexican Light:					
1st Bonds	5	5	101½	+1	4 18 7
Rio 5% Bonds	5	5	106½	..	4 13 9
Southern Rly.:					
5% Prefd.	5	5	77	+½	6 9 9
5% Pref.	5	5	117	−½	4 5 6
T. Tilling	10	10	58/-	..	3 9 0
West Riding	10	10	45/-xd	+9d.	4 9 0

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Mar. 14	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron.Elec.Ord. ..	10	15	55/–	..	5 9 1
Assoc. Elec.:					
Ord.	10	10	52/6	+3d.	3 16 0
Pref.	3	8	39/6	..	4 1 0
AutomaticTel.&Tel.	12½	12½	61/–	–1/–	4 0 8
Babcock & Wilcox	11	11	30/–	..	4 8 0
British Aluminium	10	10	48/–	..	4 3 4
British Insul. Ord.	20	20	5⅛	..	3 15 4
British Thermostat (5/–)	18½	18½	19/–	..	4 17 4
British Vac. Cleaner (5/–)	15	30	27/–	..	5 11 1
Brush Ord. (5/–)	6	8	9/–	..	4 9 0
Burco (5/–) ..	15	17½	15/6	..	5 13 0
Callender's ..	15	20	102/–	+9d.	3 18 5
ChlorideElec.Storage	15	15	80/–	..	3 15 0
Cole, E. K. (5/–)	10	15	28/–	+1/–	2 17 8
Consolidated Signal	24	27½	6xd	..	4 11 6
Cossor, A. C. (5/–)	7½*	10*	23/–	..	2 3 6
Crabtree (10/–) ..	17½	17½	38/3xd	..	4 11 5
Crompton Parkinson Ord. (5/–) ..	20	22½	29/–	..	3 17 7
E.M.I. (10/–) ..	6	8	28/–	..	2 17 2
Elec.Construction	10	12½	50/–	..	5 0 0
Enfield Cable Ord.	12½	12½	59/–	+6d.	4 0 4
English Electric .	10	10	50/6	..	3 19 3
EnsignLamps(5/–)	25	15	22/6	+½	3 6 8
Ericsson Tel. (5/–)	22*	20*	52/9	..	1 18 0
Ever Ready (5/–)	40	40	39/–	..	5 2 7
Falk Stadelmann	7½	7½	33/6	..	4 9 7
Ferranti Pref. ..	7	7	30/–	..	4 13 4
G.E.C.: Pref.	6½	6½	34/–	..	3 16 6
Ord.	17½	17½	92/6	..	3 15 6
Greenwood & Batley	15	15	41/3	..	7 5 9
HallTelephone(10/–)	12½	12½	26/3	..	4 15 1
Henley's (5/–) ..	20	20	26/3	..	3 16 2
4½% Pref. ..	4½	4½	24/–	..	3 15 0
Hopkinsons ..	15	17½	62/6	..	5 12 0
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6½	..	4 18 0
Johnson & Phillips	15	15	72/–	+1/6	4 3 4
LancashireDynamo	20	22½	93/6	+6d.	4 16 2
Laurence,Scott(5/–)	12½	12½	13/–	..	4 16 2
London Elec. Wire	7½	7½	34/6	..	4 7 0
Mather & Platt .	10	10	53/9	..	3 14 9
Metal Industries (B)	5	8	45/–	..	3 11 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	102/6	..	3 18 2
Pye Deferred (5/–)	25	25	26/3	..	4 15 3
Revo (10/–) ..	17½	17½	38/6	..	4 11 0
Reyrolle ..	12½	12½	68/9	..	3 12 8
Siemens Ord. ..	7½	7½	33/–	–6d.	4 11 0
Strand Elec. (5/–)	7½	10	7/9	..	6 9 0
Switchgear & Cowans (5/–) ..	10	20	18/–	..	5 11 1
T.C.C. (10/–) ..	5	5	18/9	..	2 13 4
T.C. & M. ..	10	10	52/–	..	3 17 0
Telephone Mfg. (5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	22/6	..	4 9 0
Tube Investments	20	20	96/6	..	4 3 0
Vactric (5/–) ..	Nil	Nil	14/6	+6d.	—
Veritys (5/–) ..	7½	7½	7/6	..	5 0 0
Vickers (10/–) ..	10	10	18/9	..	5 6 8
WalsallConduits(4/–)	55	55	46/6	+6d.	4 14 7
Ward & Goldstone (5/–)	20	20	26/6	+6d.	3 15 6
WestinghouseBrake	12½	14	70/–	..	4 0 0
West, Allen (5/–)	7½	7½	7/3	..	5 3 5

* Dividends are paid free of Income Tax.

Stocks & Shares (*Continued from page* 391)

around 28s. Cossor keep steady at 23s.; Philco, after being 11s. 6d., spurted to 12s. 7½d. Walsall Conduits are being bought by provincial investment; the price, at 46s. 6d., shows a gain of the pence. Lancashire Dynamo at 93s. 6d. are similarly better. Lancashire Transport at 45s. 6d. are unchanged on the dividend being again made up to 10 per cent. for the year. Enfield Cables are better at 59s. Ward & Goldstone improved to 26s. 6d. Hopes of a dividend on Vactric ordinary are reflected in a further rise to 14s. 6d. in the price. The miners' strike had comparatively little effect upon market quotations.

Public or Private Control

Sir Alexander Roger has evoked fresh attention to the question of free enterprise *v.* official control by his speech at the Midland Electric Corporation for Power Distribution meeting. Sir Roger speaks strongly and feelingly on a subject which is of vital consequence to the electrical industry as a whole. He admits that re-arrangements may have to be made within the industry itself, in order that the best results may be obtained for the public benefit. His ideas are directly opposed to nationalisation, and he declares that "without rivalry, efficiency dies."

British Power & Light

British Power & Light Corporation sold energy in 1943 to the extent of £180,000 more than in the previous year, but the net profit, at £126,983, is about £14,000 down. Taxation takes £208,500, some £1,000 more than in 1942. The dividend is maintained, as already announced, at 5 per cent., making 7 per cent. for the year, and the price of the shares remains unchanged at 32s. 6d., showing a yield of £4 6s. 2d.

Telegraph and Telephone

Communication stocks and shares are a good market. Anglo-Portuguese Telephones have gone back to 24s.; apart from this, the changes are upward. Cable & Wireless ordinary at 81 is up 10s., and Globe Telegraph ordinary at 37s. 6d. are 6d. to the good. Many thousands of the latter have changed hands within the past fortnight, the yield attracting notice. There has been a rise of 9d. in Canadian Marconi.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AKTIEBOLAGET Elektrod.—" Device for indicating the voltage of batteries in electrical sets such as radio sets." 28768/30. November 15th, 1938. (559513.)

Automatic Telephone & Electric Co., Ltd. (A. C. Corner).—" Automatic adjusting arrangements for electrical networks." 11566. August 18th, 1942. (559484.)

Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker.—" Electrical signalling systems." 11701. August 20th, 1942. (559539.)

Benjamin Electric, Ltd., and G. D. Skinner.—" Luminous vitreous enamel." 13900. October 3rd, 1942. (559573.)

C. G. M. Bennett.—" Means for locking electric incandescent lamps in their sockets." 11794. August 21st, 1942. (559488.)

British Insulated Cables, Ltd., and J. C. Quayle.—" Guides for the transmission of electric waves." 8696. July 10th, 1941. (559585.)

British Thomson-Houston Co., Ltd.—" Excess voltage protective devices for electric circuits." 13015/42. September 17th, 1941. (559499.) " Starting switches for electric discharge devices." 17018/42. December 4th, 1941. (559507.) " Turbine bucket wheels and the like." 4604/43. March 28th, 1942. (559510.) " Fluorescent tube coating." 12096/42. September 2nd, 1941. (559563.) " Starting switches suitable for electric discharge lamps." 13524/42. September 27th, 1941. (559633.)

British Thomson-Houston Co., Ltd., and K. R. Hopkirk.—" Apparatus for use in measuring the frequency and relative phase and amplitude of mechanical vibrations." 12262. August 31st, 1942. (559563.)

British Thomson-Houston Co., Ltd., P. Mathews and J. Dyson.—" Electric protective arrangements of the reactance type." 16195. November 16th, 1942. (Addition to 549257.) (559638.)

Brush Electrical Engineering Co., Ltd., and H. F. Yelland.—" Guides for the operating handles or levers of electric switches." 11702. August 30th, 1942. (559540.)

Carr Fastener Co., Ltd., and G. Wagstaff.—" Electrical contacts of holders for thermionic valves, plugs and the like." 12077. August 27th, 1942. (559562.) " Holders for thermionic valves and other electric devices." 14401. October 14th, 1942. (559579.)

A. C. Cossor, Ltd., and F. R. W. Strafford.—" Radiogoniometers." 16421. November 13th, 1940. (559583.)

Creed & Co., Ltd., A. E. Thompson and R. D. Salmon.—" Telegraph apparatus." 11824. August 21st, 1942. (559558.)

De Havilland Aircraft Co., Ltd., and G. D. Leete.—" Wire-stripping apparatus." 15036. October 26th, 1942. (559634.)

F. B. Dehn (Chicago Flexible Shaft Co.).—" Electric motor for food mixers and the like." 2482. February 25th, 1942. (559587.)

English Electric Co., Ltd., and R. P. E. Tabb.—" Control of electric motors driving boiler auxiliaries." 9899. July 15th, 1942. (559529.)

Ericsson Telephones, Ltd., S. H. D. Ward and A. Morley.—" Armatures for electrical machines." 13392. September 23rd, 1942. (559598.)

A. Faber.—" Electric condensers of variable capacity." 11999. August 26th, 1942. (559627.)

Igranic Electric Co., Ltd.—" Step-by-step operating mechanism." 14352/42. October 17th, 1941. (559601.)

Johnson & Phillips, Ltd., and S. J. Wimsett.—" Electrical fuses." 12254. August 31st, 1942. (559564.)

C. E. P. Jones and J. W. Hotham.—" Electrical timing arrangements." 11700. August 20th, 1942. (559538.)

Machlett Laboratories, Inc.—" High-tension electrical apparatus." 4487/42. April 25th, 1941. (559481.)

J. W. Miller and Goodmans Industries, Ltd.—" Electrical coil winding machines." 9929. July 16th, 1942. (559531.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips'Gloeilampenfabrieken).—"Method of forming anodes in current converting tubes." 13228. October 14th, 1941. (559515.)

T. Ridings.—" Selective rotary-arm electric switches." 14189. October 9th, 1942. (559600.)

G. R. Shepherd (Westinghouse Electric International Co.).—" Method of forming ceramic bodies." 8084. June 12th, 1942. (559618.)

Siemens-Schuckert (Great Britain), Ltd., and A. White.—" Timing mechanism for operating electric switches." 11906. August 24th, 1942. (559625.)

S. J. Smith.—" Manufacture of electrodes for use with piezo-electric crystals." 13767. October 1st, 1942. (559502.)

S. Smith & Sons (Motor Accessories), Ltd., and E. J. Kirby.—" Permanent or electromagnets." 9443. July 7th, 1942. (559526.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—" Secondary electron emissive electrodes." 9971. July 17th, 1942. (559591.)

Sturtevant Engineering Co., Ltd., H. W. Wagner and J. H. Hellyer.—" Electrostatic precipitation of particles suspended in gases." 10021. July 18th, 1942. (559532.)

Telegraph Construction & Maintenance Co., Ltd., J. N. Dean, E. W. Smith and R. Sear.—"High-frequency electric conductors and cables." 6428. May 12th, 1942. (559518.) " High-frequency electric conductors and cables." 1141/44. May 12th, 1942. (Divided out of 559518.) (559545.)

Whipp & Bourne, Ltd., and I. T. L. Whipp.—" Electrical energy distribution systems and protective arrangements therefor." 9075. June 7th, 1943. (559512.)

Woodhouse & Mitchell, Ltd., and D. Walker.—" Means for controlling electrically-driven machine tools incorporating change speed mechanism." 13758. October 1st, 1942. (559501.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Abertillery.—March 30th. Electricity Department. Materials, including cables, meters, lamps for public lighting and domestic apparatus, for the year ending March 31st, 1945. (March 10th.)

Burnley.—March 20th. Town Council. Supply of electric lamps for hospitals, clinics and institutions, etc. from April 1st to September 30th, 1944. Forms of tender from the Public Assistance Officer, 20, Nicholas Street, Burnley; tenders to A. Glen, Town Clerk.

Kilmarnock.—March 22nd. Town Council. Supply of articles including electric lamps for all the Corporation departments and for street lighting. Forms, etc., from burgh surveyor, 7, Green Street; tenders to town clerk.

Manchester.—March 22nd. Electricity Committee. Service cut-outs and cables. (March 3rd.)

North-West Midlands.—May 10th. Joint Electricity Authority. Piping equipment and overhead electric cranes. (March 3rd.)

Omagh. — March 25th. Mental Hospital Joint Committee of Management. Supply of electrical requisites and engineering machinery for six months from April 1st. Items are included in a war contract list, which must be applied for. Particulars from, and tenders to, O. L. Walsh, clerk to the Joint Committee of Management, Omagh Mental Hospital.

Wortley.—March 31st. R.D.C. Electrically driven borehole pumping unit. J. Morton, Council Offices, Grenoside, nr. Sheffield.

Orders Placed

Birmingham.—Electricity Committee. Accepted during the last three months:—Switchgear.—G.E.C. Condenser tubes.—Earle, Bourne & Co., I.C.I. Metals; Birmingham Battery & Metal Co.; Charles Clifford & Son; James Booth & Co. Condenser tube fittings and packings.—Crane Packing. Reconditioning of tube nests of oil coolers.—C. A. Parsons & Co. Repairs to motor generator.—Dowding & Mills. Repairs to flue gas trunking.—J. Houston & Sons. Battery.—Britannia Batteries.

London.—Metropolitan Water Board. Accepted. Installation of electric lighting and heating:—Lee Bridge (£177). H. J. Cash & Co. Eynsford (£113) Smith & Hammond. Electrically driven two-motor crab for Hampton works (£550).—London Hoist & Machinery Co.

North Riding.—County Council. Accepted. Alpine sun lamp for Guisborough children's nursery (£52).–Watson & Sons (Electro Medical).

Southport.—Gas Committee. Accepted. Electric lifting gear at gasworks (£124).—George W. King.

Electricity Committee. Accepted. Economiser replacements (£3,239).—E. Green & Son.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Twelve huts for educational purposes (£11,700); T. F. Henderson, city engineer, Town House.

Alloa.—Building to be used as foundry for Harland Engineering Co., Ltd.; manager.

Bedworth.—British Restaurant, King's Hall, for U.D.C.; N. D. Martin, surveyor, Council Offices, Bedworth, near Nuneaton.

Birmingham. — Restaurants (£38,728) and emergency hostels (£69,361); city engineer.

Blackburn.—Central bus station and markets; W. Pickstone, borough surveyor, Town Hall.

Bournemouth.—Stores and workshops, 96-98, Castle Lane; Aish & Co., Ltd.

Burton - on - Trent. — Extensions, Technical School, Branstone Road (£1,711); T. Lowe & Sons, Ltd.

Chatham.—Central kitchen for school meals, White Road; R. L. Honey, borough architect, Town Hall.

Chesterfield. — Miners' canteen, Ramcroft Colliery; Hardwick Colliery Co., Ltd., Heath Chesterfield.

Chester - le - Street.—Cinema; Edwin Lawson, Barras Buildings, Newcastle-on-Tyne.

Chorlton - cum - Hardy. — Alterations to Invercoe, Edge Lane (electrical work); H. S. Fairhurst & Son, architects, 55, Brown Street, Manchester, 2.

Dover.—New Church of St. Mildred, Capel-le-Ferne; secretary to Capel-le-Ferne Parochial Church Council.

East Ham.—Junior School of Commerce; borough engineer, Public Offices, Town Hall, London, E.6.

Essex.—Additions to Hornchurch Junior School (£2,259), school huts at Braintree County High School, school canteen at Newport, Essex (£1,530), nurses' home at Hermon Hill, Wanstead (£1,699) and conversion of casual wards at St. John's Hospital, Chelmsford; county architect, Chelmsford.

Gloucester. — Crematorium, Coney Hill; borough surveyor, Guildhall.

Gloucestershire.—Technical College, Soundwell School, near Bristol; county architect, Shire Hall, Gloucester.

Grimsby.—Hut for rehabilitation (£3,328); secretary to the Grimsby and District Hospital Managing Committee.

Halifax.—Laundry, Welfare Home (£13,844); D. T. Lloyd Jones, borough engineer, Crossley Street.

Hertfordshire.—Two maternity wards (£5,000) at Maternity Home, Watford; County Clerk's Department, Castle Street, Hertford.

Heywood.—Central meals kitchen, site between Queen Street and Queen's Park Road; H. A. Fox, town clerk, Municipal Buildings.

Kilmarnock.—Houses at Hillhead for Corporation (electric lighting); James Hay & Steel, architects, West George Street.

Kingston - upon - Thames.—Central school canteen, Fairfield; borough engineer, Guildhall.

Leicester.—New schools, central institute and youth centre; J. L. Beckett, city engineer.

London. — WANDSWORTH. — Workshop, Douglas Wharf, Brewhouse Lane; F. G. Minter, Ltd., building contractors, Ferry Works, Putney High Street, S.W.15.

Newcastle - upon - Tyne. — Installation of electrical equipment at several school sculleries; F. Harvey, architect, Education Offices.

Northampton.—Alterations to X-ray Department (£2,000); secretary, Northampton General Hospital, Billing Road.

Northumberland.—Extensions to Ashington Mining School; county architect, County Hall, Newcastle-on-Tyne.

Rochester.—Central canteen (£3,000); city surveyor, King Edward Road.

Stockport.—Offices; W. H. Crossley, Ltd.

Sunderland.—Addition to works; Marshall, Tweedy and Bourn, architects, Grainger House, Newcastle-on-Tyne.

Prefabricated houses; J. E. Lewis, borough engineer.

Warrington.—Store and workshop, Oakwood Avenue; J. B. Mellor.

Bus shelters (bulkhead electric lighting); borough engineer.

Wigan.—Extensions to Junior Technical School (£4,000); L. Lyons, borough engineer, Municipal Buildings, Library Street.

Wolverhampton.—Two new schools; W. M. Law, borough engineer, Town Hall.

Forthcoming Events

Saturday, March 18th.—*London.*—At R.S.A., Adelphi, W.C.2, 3 p.m. Institution of Electronics. "Thermionic Valve Rectifiers," by Mr. F. E. Henderson.

Manchester.—At Engineers' Club, 2.30 p.m. I.E.E. North-Western Centre. "Internal Discharges in Dielectrics," by Dr. A. E. W. Austen and Miss W. Hackett, Ph.D.

Leeds.—Hotel Metropole, 3 p.m. Yorkshire North-West Branch, Association of Mining Electrical and Mechanical Engineers. "Question and Answer" meeting.

Monday, March 20th.—*London.*—At Institution of Electrical Engineers, 5.30 p.m. Informal meeting. Discussion on "Industry's Opportunity in Education," to be opened by Dr. P. Dunsheath, O.B.E.

Liverpool.—At Royal Institution, Colquitt Street, 5.30 p.m., I.E.E. Mersey and North Wales (Liverpool) Centre. "Industrial Fire Risks," by Messrs W. Fordham Cooper and F. H. Mann.

Birmingham. — Birmingham Electric Club. "Fifty Years in the Electrical Industry," by Mr. W. E. Warrilow.

Tuesday, March 21st.—*London.*—At I.E.E., 5.30 p.m. Wireless Section. Discussion on "Treatment and Tests for Extreme Climatic Conditions," to be opened by Mr. E. M. Lee.

London.—At Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6.15 p.m. Association of Supervising Electrical Engineers. Illustrated lecture "Some Aspects of Electric Resistance Welding," by Mr. L. B. Wilson.

Leeds.—Great Northern Hotel, 6 p.m. I.E.E. North Midland Centre informal meeting. "Lighting in the Woollen and Worsted Industry," by Mr. J. W. Howell.

Wednesday, March 22nd.—*Birmingham.*—At James Watt Institute, 7 p.m. I.E.E. South Midland Students' Section. "Engineering Economics," by Sir Frank Gill.

Thursday, March 23rd. — *Bradford.* — At Technical College, 7 p.m. Electronics Society. Lecture on "The Electron Microscope."

Friday, March 24th.—*London.*—39, Victoria Street, S.W.1, 6.15 p.m. Informal meeting of Junior Institution of Engineers. "Survey of Protective Devices for Electric Machinery," by Mr. R. J. Merralls.

London.—Albemarle Street, W.1., 5 p.m. Royal Institution. "Lightning Calculations with Light," by Sir Lawrence Bragg.

Manchester.—At Engineers' Club, 6 p.m. I.E.E. North-Western Centre Wireless Group. Informal discussion on "Wire *v.* Wireless for Communications," to be introduced by Mr. G. J. S. Little and Dr. N. H. Searby.

Manchester.—At Engineers' Club, 6.30 p.m. Manchester Association of Engineers. "Modern Grain Handling and Flour Milling Machinery," by Mr. G. M. Anderson.

Birmingham. — Imperial Hotel, 6 p.m. Illuminating Engineering Society. "The Thyratron and some of its Applications," by Mr. A. J. Maddock.

Glasgow.—Cadoro Restaurant, 6 p.m. Illuminating Engineering Society. "Fluorescent Lamps and their Applications," by Mr. A. L. Randall.

Monday, March 27th.—*London.*—At Northampton Polytechnic, E.C.1. Electrodepositors' Technical Society. "Nickel Deposition from Low pH Electrolytes," by Mr. N. R. Laban.

Newcastle-on-Tyne.—Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "Maintenance of Distribution Plant and Mains on AC Networks," by Messrs. F. N. Beaumont, B.Sc. (Eng.), and F. A. Geary.

Wigan.—At Mining and Technical College, 7 p.m. Association of Mining Electrical and Mechanical Engineers (N.W. Branch). Lecture on "Underground Fires," by Mr. A. J. G. Coulshed.

I.E.E. Transmission Section

AN additional meeting of the Transmission Section of the Institution of Electrical Engineers will be held on Tuesday, March 28th, at 5.30 p.m. (tea at 5 p.m.) when Mr. P. E. Rycroft, M.B.E., will open a discussion on the supply and distribution sections of the report on "Electricity Supply, Distribution and Installation" prepared by Sub-Committee No. 3 of the Post-War Planning Committee.